Agricultural gazette of New South Wales

New South Wales, Australia. Dept. of Agriculture, Henry Charles Lennox Anderson, New South ...


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PREFACE.

THE introduction to our readers of the first part of Volume V of the *Agricultural Gazette* would appear to be a convenient opportunity for a brief retrospective glance at the work of last year, and a hint of the possibilities of 1894.

There is one point upon which it is fair to express sincere gratification, and that is the continued and increased appreciation of readers both at home and abroad in the efforts of contributors to the *Gazette* to benefit agriculture in all its branches. It must not be forgotten that the whole of these contributions are made *con amore*, and the Government has never been called upon for a single shilling by way of remuneration to those who, month after month, assist in sustaining the reputation of this now well-established work. With regard to the year just completed—and particularly the latter half of it—the staff of the Department was diminished one-half. At the same time, in spite of the transfer of the crop-reporting to the office of the Government Statistician, the actual work performed by officers has steadily and perceptibly increased. While showing that our agriculturists appreciate our efforts to render their calling more remunerative, it will be apparent that an increase in inquiries for information must of necessity make very large calls on the energies of the reduced staff, so that their time for the work of article-writing is practically confined to the hours which are euphoniously termed "spare time."

Among the new departures which were initiated during the year 1893 may be mentioned the exhaustive inquiries which were conducted by Dr. Cobb regarding the diseases affecting sugar-cane on the Northern rivers, and the no less exhaustive experiments which are still proceeding at Moss Vale with a view to mitigating the effects of worms in sheep; and in this branch of inquiry (the Pathological) it should be added that the investigations regarding rust in wheat made considerable progress during the year. None of these matters are such as can be settled off-hand, but it is satisfactory to be able to report undoubted progress. There are two other branches of agriculture as to which a distinct advance has been effected. Experiments were commenced, and are still proceeding, with a large number of varieties of tobacco, with the object of ascertaining those most suitable of the most marketable varieties for each of our tobacco-growing districts. These experiments were willingly undertaken by experienced men, and the results will be fully recorded during the present year. A definite, and, it is believed, wise step has been taken in connection with our wine trade, full particulars of which are given in the present issue. There is no doubt that even a limited progress in the direction decided upon must have the effect of opening up the London market to wines which have only to be properly known in order to secure a lasting appreciation by European wine-drinkers. The fruit trade also received a full share of attention, and the efforts of the Pomological Committee are being directed to promoting the cultivation of such fruit as will command the foreign market, and render this neglected industry the remunerative one which it has become in other parts of the world. Given good varieties, careful handling, and tasteful and intelligent packing, and New South Wales will rapidly attain the eminence to which her soil a[illegible] climatic conditions entitle her. While on this su[illegible]

worthy of note that the result of the cold-storage experiments conducted by the Department has cleared the way for a more satisfactory result of exporting to distant markets. Another important industry, that of Sericulture, has also received practical attention. A large quantity of valuable graine, or eggs, has been received as a present from Italy, and the Department has obtained permission from the manager of the A. A. Company to utilise their mulberry plantation at Booral for the purpose of cultivating and feeding the worms, and imparting instruction in all branches of the industry.

The work at the Agricultural College at Richmond will doubtless be rendered more effective when the new dairy and other buildings now being erected are completed, and in the meantime the number of students continues to increase, while the results of the examination prove conclusively the completeness of the training imparted. This work of education will receive considerable impetus and assistance by the establishment of experimental farms at Wagga and on the Richmond River, to which it is proposed to draft such students as may desire to gain practical and scientific training in fruit and vine growing at the former, and a knowledge of semi-tropical farming at the latter centre.

In reporting progress, as it appears from the Departmental point of view, it is satisfactory to note the progress of the past year, as shown by the increased area of land under cultivation. Without claiming any unreasonable credit for assisting in promoting this increase, the Department may be permitted to offer its congratulations to our pioneers, and to assure them of cordial co-operation in the future as in the past.

Useful Australian Plants.

By J. H. MAIDEN,
Consulting Botanist.

No. 5.—The Black Bean or Moreton Bay Chestnut.

(*Castanospermum australe*, A. Cunn.)

Aboriginal Names.—"Irtalie" of the aboriginals of the Richmond and Clarence Rivers, New South Wales (C. Moore). "Bogum" was an aboriginal name in the northern parts of the same Colony; "Kongo" of the natives of the Russell River, Queensland (F. M. Bailey).

Vernacular Names.—Because of the seeds, which are very large beans, this tree goes under the name of bean-tree; and because of the dark colour of the wood, and partly by way of distinction from the red bean (*Dysoxylon Muelleri*), it is usually known by timber merchants as black bean. Moreton Bay Chestnut is an old name for the tree, because it was first found in the Moreton Bay district.

Botanical Name.—*Castanospermum*, from the Latin *castanea*, a chestnut, the sweet chestnut, and *spermum*, a seed. The tree is confined to Australia, and in non-Australian descriptions of it the name is usually explained on the ground that "the seeds are roasted like chestnuts." This matter is alluded to later on. It belongs to the natural order *Leguminosæ*.

Flowers.—They are borne on the last year's wood, bear a general resemblance to pea-flowers, though more solid and fleshy, and in colour vary from yellow, through all stages of orange, to coral red. They are very handsome, though not available for cut flowers.

Fruit.—The seeds strongly resemble the horse-chestnut of Europe, but they are usually much larger in size; and they are found in a very thick pod, almost circular in section, like a distended broad bean.

The Bean-tree as furnishing food for man.—This tree was discovered by Mr. Charles Fraser, colonial botanist, and Mr. Allan Cunningham, a botanist then attached to the Royal Gardens at Kew, and who afterwards succeeded Mr. Fraser at Sydney. The plant is figured and described in Hooker's *Botanical Miscellany*, vol. i (1830), which contains an account of a botanical trip made by these gentlemen in the neighbourhood of Moreton Bay. A forest "near Brisbane Town," contains "a most interesting new plant producing fruit larger than a Spanish chestnut, by which name it is here known. . . . By the natives the fruit is eaten on all occasions. It has, when roasted, the flavour of a Spanish chestnut, and I have been assured by Europeans who have subsisted on it exclusively for two days, that no other unpleasant effect was the result than a slight pain in the bowels, and that only when it is eaten raw." Sir William Hooker adds a note: "Although the large and handsome seeds are eaten by the natives of Brisbane River, and by the convicts in that part of our Colony, as substitutes for our Spanish

chestnuts, I have found them hard, bitter, and their flavour not unlike that of the acorn." Extended experience shows that very few stomachs can tolerate them. Dr. T. L. Bancroft, of Brisbane, has examined the beans, and is very emphatic in regard to their deleterious properties as far as man is concerned. He states that if a small piece of the bean be eaten it causes severe diarrhœa, with intense griping, and he states that it does this whether it has been previously soaked in water or even roasted. He states that no poisonous principle is removed by water, and no part of the plant is bitter. Mr. Charles Moore, Director of the Sydney Botanic Gardens, exhibited a sample of starch or flour of the beans at the Intercolonial Exhibition of Melbourne, 1866, and he supplied the following information concerning his exhibit: "The beans are used as food by the aborigines, who prepare them by first steeping them in water from eight to ten days. They are then taken out, dried in the sun, roasted upon hot stones, and pounded into a coarse meal, in which state they may be kept for an indefinite period. When required for use the meal is simply mixed with water, made into a thin cake, and baked in the usual manner. In taste, cakes prepared in this way resemble a coarse ship biscuit." Usually the aborigines scrape it, by means of jagged mussel shells, into a vermicelli-like substance, prior to soaking it in water. The starch or flour is neither better nor worse than many of the food starches at present consumed for food. As an experiment, a chemist at Lismore once made 40lb. of starch from the beans, which he sold at 4d. per lb. Opossums are fond of the beans.

The Bean-tree as a Plant Injurious to Stock.—Stock-owners have long waged war against this tree, owing to the belief that cattle and horses are poisoned through eating the seeds. They are not, however, a poison in the strict sense of the term, since no alkaloid or poisonous principle can be found in them. They have frequently been examined by chemists, and Mr. W. M. Hamlet, Government Analyst, has reported on the subject to this Department with negative results. (*Annual Report of Department of Mines*, N.S.W., 1886 p. 46). All the same, the beans kill the stock, owing to their highly indigestible character, the indigestible portion in time forming a ball in the stomach. The leaves also are found to be injurious, and animals which take to eating them become very fond of them, and when taken away return long distances to these trees, and according to some accounts become affected similarly to animals which eat the Darling Pea, and, if not carefully looked after, they will pine away and die. Following are some interesting notes in regard to bean poisoning on the Richmond River:—"1883 was a dry season, and grass scarce. —— informed me that he had lost over 100 head of cattle by bean-poisoning. Next day my attention was drawn to a few cattle in the stockyard said to be poisoned by eating beans. I inquired of the stockman if he had any proof that they had eaten beans, when he pointed to a beast that had died the day before, and beans had been taken from its stomach. In reply to my questions he said he expected some of the cattle in the yard to recover. They appeared much purged, discharging thin, watery, fœcal matter. Cattle seem to be attracted by the bright green appearance of the beans as they lie upon the ground. Many cattle and horses on the Richmond have been lost from bean poisoning. —— lost a valuable entire horse and cattle in this way; and many others have similar experience. It appears to affect horses in a different way to cattle. —— informed me that while removing horses from a paddock in which the bean-tree was growing two of them died without previously showing any symptoms of poisoning." The seeds are also rapidly fatal to pigs in some cases, probably when devoured on an empty stomach.

Leaves.—Pinnate, as shown in the drawing, and in a mass, of more than ordinarily handsome appearance. The foliage is dark and the whole tree shapely, quite justifying Cunningham's laudatory remarks in regard to it. Those who are not familiar with the tree in its native habitat may see some magnificent specimens in the Sydney Botanic Gardens.

Exudation.—A gum from this tree was shown in the New South Wales Court at the Paris Exhibition, 1867, but I cannot find any account of it, and it does not appear to have been examined. The bark of this tree is often glazed in patches with a gummy exudation, but I have not been able to get a quantity approximately pure. It is not likely to have commercial value, as it does not appear to be soluble, but the samples seen may have been those from which the soluble portion had been washed away by the rain, leaving the insoluble or metarabic portion. It would be desirable to investigate the gum from a scientific point of view, and doubtless some North Coast residents can favour the Department with specimens of it.

Bark.—Smooth, dirty grey externally, pale brown or yellowish internally. A tree 2 feet in diameter has a bark (say) ½-inch thick. It is not astringent, and therefore not to be thought of by the tanner. It is, however, bitter to the taste, and probably contains saponin, though I have not chemically examined it.

Timber.—This timber is easiest described by stating that it strongly resembles walnut. I have always endeavoured to urge moderation in advocating the claims of colonial timbers, feeling sure that our timbers have received a good deal of harm from indiscriminate praise; but, having kept Black Bean under observation for a number of years, and having caused large quantities of it to be worked up into various articles, I think very highly of it. I look upon it as scarcely inferior to walnut. People sometimes complain of it that it warps and splits a little, but it does not do this if it receives the seasoning that cabinet woods receive in the northern hemisphere. Let Black Bean be felled when the sap is down, and given a reasonable amount of seasoning, and I do not hesitate to say that it may be pitted against walnut without disgrace. Black Bean is easier to dress than even cedar; in fact it is almost perfection as regards the ease with which a surface can be got on it. It polishes readily, but the grain is inclined to rise under polish. This timber often shows a beautiful figure; planks which have the figure in bands, like the marking of an agate, are really gorgeous. Mr. Allen Ransome tested some specimens sent to the Colonial and Indian Exhibition. He thus reports:—"A beautifully figured, brown wood. The sample sent, being very wet, was tried under somewhat unfavourable circumstances. A baluster was turned from it, and some boards and panels planed, the work from both lathe and planing-machine being excellent. The wood should prove valuable for cabinet-makers, but should be thoroughly seasoned before being used, as it shrinks very much in drying." I have already alluded to seasoning in connection with this timber, but Mr. Ransome's specimen, "being very wet," is hardly a fair one from which to draw conclusions. In the building of the Austral Banking Company, in Phillip-street, I have seen Black Bean used for framing twelve months after felling, and it was standing splendidly two years afterwards. A piece of Black Bean, bone dry, having been seasoned over twenty-five years, has a weight which corresponds to 39 lb. 8 oz. per cubic foot; but, as a rule, the timber is heavier than this. Although the great use and value of this timber is for cabinet-work, yet it has been used for rougher work. I am informed that on the Tweed River it has been used for culverts, and when free from sap it lasts well under ground. Mr. Forester Pope, of

Murwillumbah, also reports:—"Very durable; will last any number of years under the ground." This is the more satisfactory, as for many years it was not considered to be a durable timber. It is also used for staves. The sap-wood is white and thick, and of all the hundreds of New South Wales timbers with which I am acquainted, I know of no other sap-wood so readily attacked and so promptly destroyed by borers as this one. Insects speedily reduce it to a flour-like substance.

Size.—A fair average height would be 60 or 70 feet, with a trunk diameter of 2 or 3 feet. At the same time it frequently attains a height of nearly double this, with a diameter of 5 or 6 feet.

Distribution.—It is usually found growing in brush land of the very richest soil, usually near the banks of rivers in the Clarence, Richmond, and Tweed River districts, but frequently in the scrub, a considerable distance from creeks and rivers. It comes as far south as the well-known Don Dorrigo Forest Reserve, in the Bellinger River District. It is also found in Queensland, extending a considerable distance along the coast districts.

Propagation.—From seed (the large "beans"). The tree can be supplied by every nurseryman.

Reference to plate (Bean tree).—A, flowering twig; B, flower, two-thirds natural size; C, standard, two-thirds natural size; D, wings and keel plates, two-thirds natural size; E, calyx, two-thirds natural size; F, stamens and pistil, two-thirds natural size; G, pistil, two-thirds natural size; H, pod or bean, about one-fifth natural size; J, seed, about two-thirds natural size; K, sketch of a tree in the Sydney Botanical Gardens.

Castanospermum australe, A. Cunn.

"Bean Tree" or "Moreton Bay Chestnut."

Two Fodder Plants interesting to the Wool-grower.

By J. H. MAIDEN,
Consulting Botanist.

WHEN we are reminded that the botanical name of lucerne is *Medicago sativa*, it will be at once conceded that agriculturists in New South Wales owe a good deal to the genus *Medicago*. It contains about forty species, and many of them are useful fodder plants. None of them are Australian, but a number of them have been introduced, some purposely, and some by accident. The name *Medicago* is said to be derived from *Medike*, a name given by the Greek Dioscorides to a grass from Media. The common English name for these plants is Medick of one sort or another. Thus, the lucerne is sometimes known as Purple Medick, those which have burr-fruits as Burr-Medicks, and so on. Those which have smooth, hookless, burrless fruits or pods, like the two species now depicted, should be given every encouragement to spread.

A few months ago Mr. C. H. Fitzhardinge, of Dubbo, sent *Medicago orbicularis* to the Department for naming, and pointed out that the fruits were without hooks to attach themselves to wool. At about the same time the following passage was contained in the *Agricultural Journal*, the official organ of the Department of Agriculture of Cape Colony. (Issue of 7th September, 1893):—"I send you seeds of two more fodder plants, *Medicago scutellata* (Bauh.) and *M. orbicularis* (All.). You, doubtless, have a careful man to start them. They are annual, but produce an immense number of fruits, which the sheep lick up and eat when pasturage fails. I have gathered as many as 1,400 seeds from a single plant." This is by Baron von Mueller, to whom, therefore, belongs the credit of widely publishing the advantages of a burrless Medick, and he has been the means of distributing both plants in many Australian localities in which it now flourishes.

Figures are now given of two species of burrless Medicks, and, as the botanical descriptions of them are not readily available to most people who have English text books (as they are not natives of Great Britain, but come from countries bordering on the Mediterranean), I give the descriptions herewith.

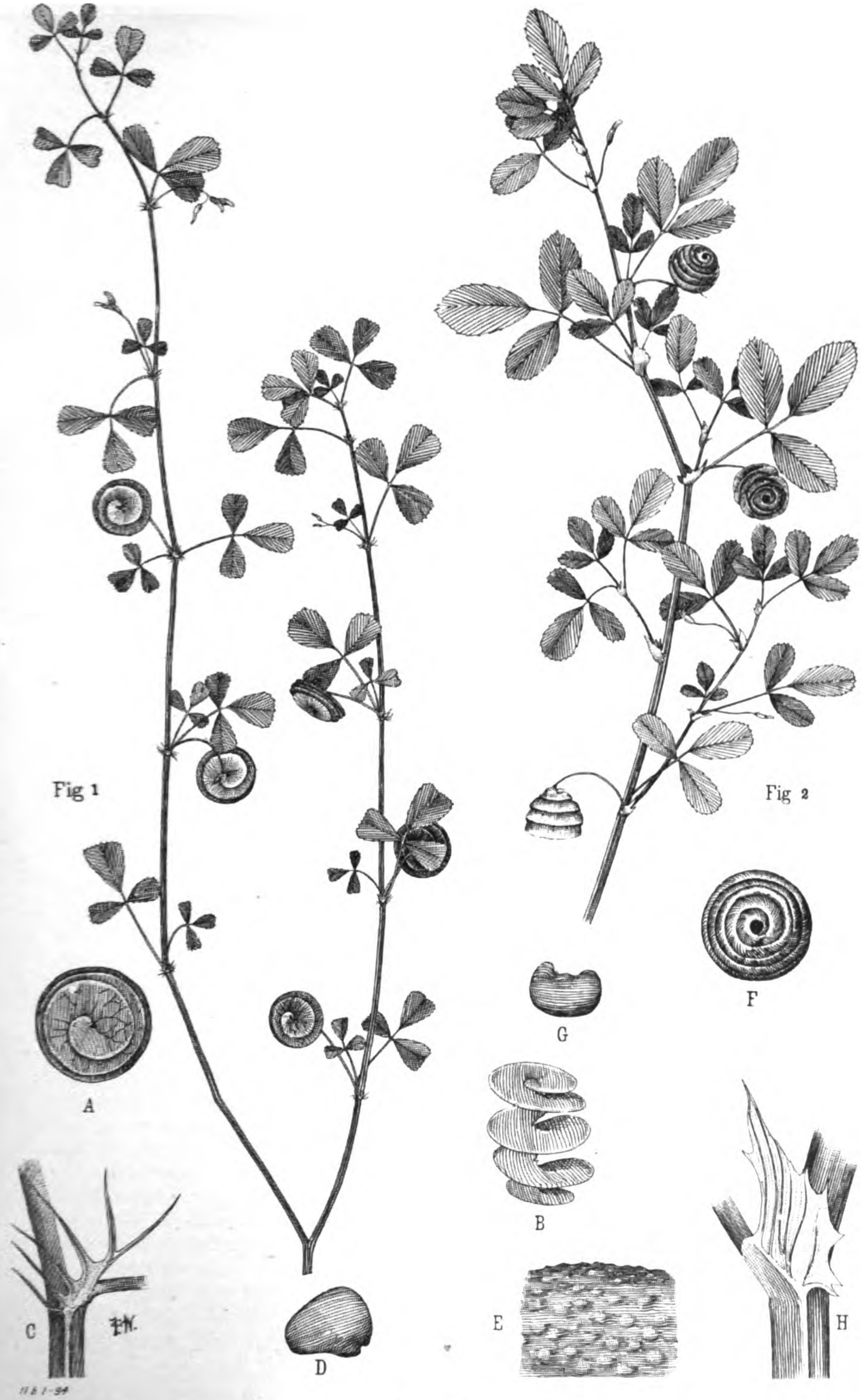
M. orbicularis, All.—Stems diffuse; leaflets obcordate, toothed at the apex; stipules jagged, the segments very narrow and diverging; peduncles 1-2 flowered; legumes cochleate, compressed, glabrous, irregularly and reticulately veined, many-seeded; seeds subtriangular, rugged from dots. Native of the south of Europe.

NOTE.—It is proposed to figure other species of *Medicago*, *Trifolium* (clover), and other genera of *Leguminosæ*, of paramount interest to the farmer, because of their value as fodder-plants, or because they are a nuisance as weeds.

M. scutellata, Bauhin.—Pilose; stems diffuse; leaflets obovate, toothed around; stipules lanceolate, toothed; peduncles 1-2 flowered; legume cochleate, many-seeded, hemispherically convex above, but flat below, beset with dense, oblique, reticulated veins; the veins thin at the margins, and anastomosing; seeds large, kidney-shaped, smooth, brown. Native of the south of Europe.

The species may be distinguished by the shape of the leaves, the pods (which are flatter and smoother in *M. orbicularis*), the shape of the seeds, and their relative roughness. The flowers of both are small; and yellow. The pod or legume is a spiral, and can be pulled out, with a little force. The French hence call *M. scutellata* "limaçon" or "the snail."

Reference to plate.--*Medicago orbicularis*—A, twisted pod (legume) end view, natural size; B, twisted pod, with spirals torn apart, natural size; C, stipule, magnified; D, seed, magnified; E, surface of seed magnified, showing warted appearance. *Medicago scutellata*—F, twisted pod (legume) end view, natural size; G, seed magnified; H, stipule magnified.



Medicks.

Fig. 1.—Medicago orbicularis, Allioni.

Fig. 2.—Medicago scutellata, Bauhin.

Cape Cotton.

(*Gomphocarpus fruticosus*, R.Br.)

A Useless and Aggressive Weed.

By J. H. Maiden.

The plant figured is a native of South Africa, but it was introduced into Australia almost at the foundation of the Colony, doubtless at the time when there was so much traffic between Capetown and Sydney. It grows from 2 to 4 feet high, and even higher; has willow-like leaves, pretty white flowers, which are succeeded by a bladdery-looking fruit (follicle), which is covered with long, soft prickles. These fruits, when ripe, contain numerous seeds, to each of which is attached a tuft of beautiful silky hairs, by means of which it is wafted about by the wind to long distances. When the plant is broken it exudes a milk-white juice.

This plant is now to be found in every one of the colonies, and has found its way a considerable distance inland. Its diffusion is owing to the abundance of its seeds and the silky hairs already alluded to. It therefore is difficult to cope with, as, if all the farmers in a district were to eradicate it from their land, a few neglected plants by a roadside or in a paddock would be sufficient to sow the district again with it.

Even when this plant was cultivated in England under glass, the plant became undesirable because of the way the seeds were blown about. A figure of it was given in the *Botanical Magazine* in the year 1814, and this is what was said of it:—"An old inhabitant of our greenhouses, where it thrives well, and frequently ripens its seeds; but the plant should be removed out of the greenhouse, or the seed vessels plucked off before they burst, otherwise the down of the seeds, being blown about the house, and adhering to whatever it touches, is apt to disfigure all the surrounding foliage."

The botanical name of this weed is *Gomphocarpus fruticosus*, R. Br., and it belongs to the *Asclepiadeæ*. The word *Gomphocarpus* is from two Greek words—*gomphos*, a club, and *carpos*, a fruit; but the name is not particularly appropriate to the plant under discussion. The word *fruticosus* is a Latin one signifying "shrubby."

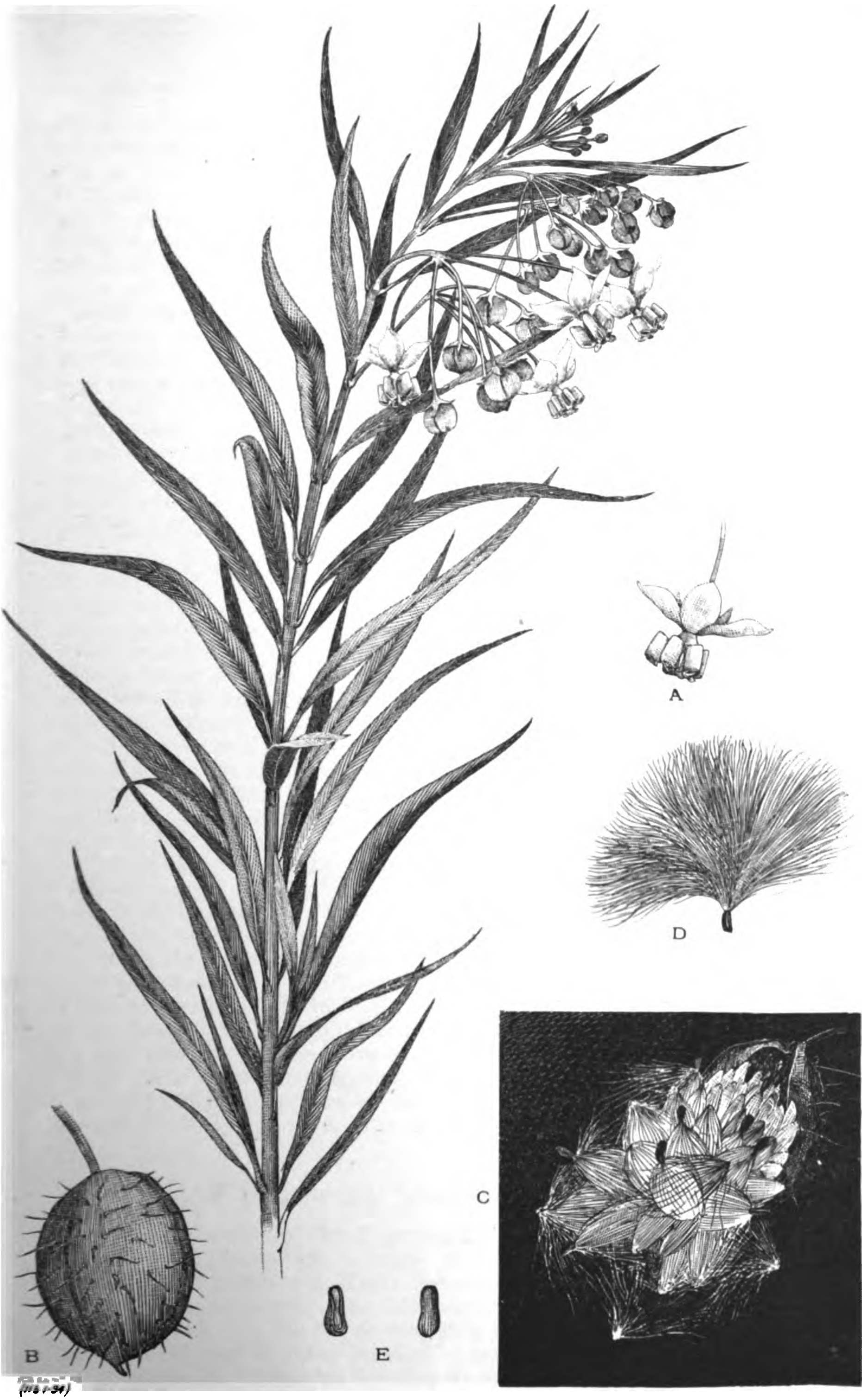
That it belongs to the *Asclepiadeæ* reminds one of the silky-seeded Doubah (*Marsdenia Leichhardtii*) of the west, eaten by the blacks; while other tuberous-rooted species of the genus used to be eaten by them as a substitute for potatoes.

The plant now figured is a weed without any redeeming feature except its good looks. Every care should be taken to destroy it before it seeds. The down from the seeds has been brought to me many a time to inquire if it

has any commercial value. It is absolutely destitute of value for textile purposes, as the fibres are too brittle, and they are otherwise unsuitable for weaving. The only use to which the material could be put would be as a substitute for kapok, and an inferior substitute too, while the collection of it could never be a commercial success in this Colony, as substances of this class, known as "silk cottons," are already very abundant in tropical countries. War must be waged against it, as it takes nourishment from the land, and is of no use to either man or beast.

In Lindley and Moore's "Treasury of Botany," Art. "*Gomphocarpus*," occurs the following passage:—"The leaves of *G. fruticosus*, the Arghel of Syria, are employed for adulterating senna. This plant is sometimes referred to *Solenostemma*." If by this is meant that the *Gomphocarpus* is a *Solenostemma*, the statement is founded on a misapprehension, for *S. argel*, Hayne, which, in Upper Egypt, yields Argel leaves (used for adulterating Alexandrian senna), is a different plant from *Gomphocarpus fruticosus*. It is figured table 175 of Bentley and Trimen's 'Medicinal Plants,' and those who desire further information in regard to it are referred to the 'Kew Bulletin' for 1891, p. 177. So that our introduced *Gomphocarpus* is useful for nothing,—not even as an adulterant."

Reference to Plate.—A, flower, May; B, fruit (follicle); C, fruit opening; D, seed with long tuft of silky hairs or coma; E, seed, front and back views.



Gomphocarpus fruticosus, R. Br.

"Wild or Cape Cotton," naturalized from South Africa.

Botanical Notes

By J. H. MAIDEN.
Consulting Botanist.

A Native Senna.

The Inspector of Stock at Warialda sends twigs of a shrub which is spreading in the neighbourhood of the Macintyre River, and asks whether it is injurious to stock. It is one of our native sennas, and its botanical name is *Cassia sophera*, Linn., var. *schinfolia*. Cassias belong to the natural order *Leguminosæ*, and some of them (of which this is one) contain an active principle which causes the leaves, bark, &c., to be purgative to man and animals. The present species may, therefore (if stock take to eating it), purge horses and cattle, but it must not be looked upon as harmful or poisonous. Some of our cassias are useful fodder-plants. At the same time, we have but little direct knowledge of the effect of cassias on stock, and I should be glad if correspondents would favour the Department with their observations on the subject. Some years ago a friend (who knows cassias), reported that they had been purging his horses, but I did not get specimens, and am unable to say what species was referred to.

The typical species is largely used in native medicine in India. Waring's "Pharmacopœia of India" mentions that an extract of the leaves is a good substitute for colocynth. The bark and seeds are likewise used as a cathartic. In Ceylon, the native doctors fry the leaves of this and allied species in castor oil, the strained product being used as an ointment for ringworm and other skin diseases. In India the plant is largely put to a similar use. In addition, the natives of tropical Asia put it to uses which appear to us more or less fanciful. Although it is not likely that the two medical uses indicated for this plant will (other remedies being available), be largely used in this Colony, it is sometimes advantageous, particularly to people away in the bush, to know the properties of the plants in their neighbourhood. If they are not required to be used, so much the better.

The Corn Gromwell (*Lithospermum arvense*, Linn.).

Mr. John Coleman, of the Experimental Farm, Wagga Wagga, sends the Department a plant which is named above, and asks for information concerning it. It is native of Great Britain, Europe, Asia, and North Africa, and has been introduced into this country for very many years, probably with dirty seed. In the old country it is found in wheat-fields (and other cereal crops), and in waste places. It has white flowers, not very showy, and is hairy. It will be observed that its root is red, and strongly resembles

alkanet. In fact, it yields a dye equal in quality to alkanet, but in less quantity. Alkanet, it will be remembered, belongs to the same natural order—the *Boragineæ*, or Borage family. Our Gromwell is hence often known as Painting root, and in Sweden at the present day it is still employed to make a red dye instead of the true alkanet. It is not a difficult plant to eradicate, but while it is quite destitute of poisonous properties, on the other hand it has not, in these days of aniline dyes, any commercial value for tinctorial purposes.

Gnaphalium Japonicum, Thunb.

An introduced weed belonging to the daisy family (*Compositæ*), has been sent from Wagga Wagga as "Take-all," and must be added to the already formidable list of weeds to which "Take-all" has been vaguely attributed.

Experiments with Pulses.

(*Continued from Vol. IV, page* 917.)

BY GEORGE VALDER.
Department of Agriculture.

THE KIDNEY OR FRENCH BEAN (*Phaseolus vulgaris, Linn.*)

TWENTY varieties were sown, ten of the green-podded and ten of the yellow-podded (butter or wax beans). The seeds were sown in drills 2 feet apart by 4 to 5 inches apart in the drill. One drill 33 feet in length was sown of each variety. The soil was not broken up as fine as it should have been for this crop, and the plants were not watered, but the plot was kept free from weeds and the weather was very suitable, being warm and very showery for the first six weeks after sowing. The crop therefore grew strongly, and the experiment proved in every way a success, every variety maturing its seed. All the yellow-podded varieties were attacked more or less by "bean rust," the result being that the yield of these did not compare favourably with that of the green-podded varieties which were almost entirely free from this disease. From my experience I have found that the yellow-podded varieties are always much more liable to "bean rust" than the green-podded ones, the latter rarely being affected. About three months after sowing, the weather being warm and dry, the beans ripened rapidly. The pods were gathered as fast as they ripened and were placed in thin calico bags and hung up in a shed to dry.

The following table will show the comparative results obtained:—

No.	Name of Variety.	Obtained from	Germinated in No. of days.	Came into bloom in No. of days.	1st edible pod, No. of days.	1st ripe, No. of days.	Yield of dry beans per drill of 33 feet.
							lb. oz.
1	Emperor William	Hockings, Brisbane	6	38	53	81	2 9
2	Prof. Blount's Blue	W. Farrer, Tharwa, Queanbeyan ..	7	43	58	72	3 8
3	Canadian Wonder	....	8	39	50	78	5 2
4	Pale Dun	....	7	35	46	74	4 11
5	Negro	....	8	38	51	79	4 9½
6	Governor Denison	....	8	36	50	78	3 5
7	Dwarf Zion House	Hockings, Brisbane	6	36	48	73	3 9
8	Carter's White Advancer ..	E. & W. Hackett, Adelaide	7	40	50	81	4 2
9	Dwarf White Caseknife ..	" " "	6	36	49	74	2 7
10	Haricot	D. Manson, Albion Park	6	42	51	77	3 4
11	German Black Wax	Yates, Sydney	6	39	49	81	1 15
12	" "	Shepherd & Co., Sydney	8	38	59	77	1 14
13	New Caledonia Black Wax ..	Parker & Co., Sydney	7	44	60	86	2 9
14	Golden Butter	Horton, Sydney	7	43	52	78	2 3
15	Yosemite Mammoth	P. L. C. Shepherd & Son, Sydney ..	7	40	58	73	2 14
16	White Wax Bean	Yates, Sydney	8	40	49	76	1 8
17	Green Gem	Adamson & Co., Melbourne	6	38	50	74	2 11
18	Golden Wax	Yates, Sydney	7	40	52	75	2 1
19	Dwarf Mont D'Or	Anderson & Co., Sydney	7	41	53	72	2 11
20	Golden Mountain	W. Farrer, Tharwa, Queanbeyan ..	7	39	51	76	2 6

Of the green-podded varieties the following gave by far the best results :—Canadian Wonder, Carter's White Advancer, Negro, and Pale Dun.

Of the yellow-podded varieties I consider the following are most worthy of cultivation here :—Yosemite Mammoth, Dwarf Mont D'Or, and Golden Wax.

Green Gem and New Caledonia Black Wax, two light green-podded varieties, are also very productive and of a fine flavour.

Short descriptions of all the varieties under trial are given herewith.

1. *Emperor William.*—Plants 12 to 15 in. high; strong and upright in habit; flowers, cream to white; pods 4 to 6 in. long; nearly straight and very fleshy; seeds white, oval and plump; a good table variety of fine flavour, but rather a shy bearer.

2. *Prof. Blount's Blue.*—Plants upright and strong, but very irregular; 12 to 18 in. high; flowers violet; pods 5 to 6 in. long, well filled; seeds small, dark crimson, nearly black; a very good variety.

3. *Canadian Wonder.*—Plants large and strong; 18 to 20 in. high; much branched; leaves large and coarse; flowers pink; pods very large and numerous; rather rough; beans large; nearly twice as long as broad; dark crimson nearly black; the hardiest, strongest grower and heaviest yielder of all.

4. *Pale Dun.*—Plants very large; much like No. 3, but leaves are darker and the flowers are white; pods 5 to 6 in. long, straight and tender; beans light dun; one of the best.

5. *Negro.*—Plants 15 to 18 in. high; much branched; leaves rather large and coarse; medium green; flowers violet; pods 5 to 7 in. long; beans quite black; a heavy yielder and one of the best for culinary purposes.

6. *Governor Denison.*—Plants much resemble No. 5, but flowers are white; pods long, straight and succulent; beans white splashed with crimson. This variety appears to be very suitable for warm districts, as on the hottest day the leaves do not droop, and with a fair amount of moisture it always yields well.

7. *Dwarf Zion House.*—Plants 15 to 18 in. high, upright; branches slender with small leaves; pods 4 to 6 in. long, slightly curved; seeds much like No. 6, but splashed with a darker crimson and not so large; a very fair variety; stands heat well.

8. *Carter's White Advancer.*—Very strong growing plants, with light green foliage; flowers white; pods very large, 6 to 8 in. long; beans white, large; an excellent variety, superior to Canadian Wonder for tenderness and flavour, but not nearly equal to it in yield.

9. *Dwarf White Oaseknife.*—Plants 15 to 18 in. high; stems slender and inclined to short runners; leaves dark green, rather large; flowers white; pods were long, but did not fill out very well; beans white, sides slightly flattened.

10. *Haricot.*—Very similar to above, but stronger in growth; pods long and well filled; beans pure white, very plump.

11. *German Black Wax.*—Plants 12 to 15 in. high; strong growing and much branched; leaves large, medium green; flowers violet; pods 4 to 5 in. long, not very numerous, but well filled; yellow and nearly stringless; medium rusty.

12. *German Black Wax.*—Similar in habit to No. 11, but not so strong in growth and both pods and beans smaller; very rusty.

13. *New Caledonian Black Wax.*—This is really a dwarf climber; stems slender and leaves small; plants much branched; pods small but very numerous; light green; very fine flavour; beans small, quite black; almost free from rust.

14. *Golden Butter.*—Plants tall and very robust; leaves large and rather coarse, medium green; flowers violet; pods about 4 in. long, thick and succulent; beans black, large and nearly round; medium rusty.

15. *Yosemite Mammoth.*—Plants 15 to 18 in. high, strong, much branched; leaves large, medium green; pods long, slightly curved, stringless, very succulent and of a beautiful golden yellow colour; a very fine table variety, nearly free from rust.

16. *White Wax.*—Plants 12 to 15 in. high, not very strong; leaves small, pale green; flowers white; pods very numerous, rather small, nearly straight, light yellow; beans dull white; very rusty.

17. *Green Gem.*—Plants fairly strong, 15 to 18 in. high; leaves small, pale green; flowers white; pods light green, rather small, narrow and straight; beans long, narrow, and rather small, of a peculiar light green colour when dry; a very distinct variety, productive, and of excellent flavour; nearly free from rust.

18. *Golden Wax.*—Plants 12 to 15 in. high, not strong; leaves small, rough, pale green; flowers dull white; pods numerous, 4 in. long, rather wide and curved; beans rather small, white speckled with red; very rusty.

19. *Dwarf Mont D'Or.*—Plants tall and slender; leaves small, rather a deep green; flowers violet; pods 4 to 5 in. long, narrow, curved, very plump, bright yellow; beans nearly round, shining, deep purple, nearly black; a very productive and good table variety, but slightly rusty.

20. *Golden Mountain.*—Resembles No. 19, but the pods are much flatter, and nearly white; although very rusty, gave a very fair yield.

Notes on Ringbarking and Sapping.

BASED ON FORESTERS' REPORTS.

COMPILED AND ANNOTATED BY J. H. MAIDEN.

THE following circular is self-explanatory:—

Department of Mines and Agriculture, Forests,
Sydney, 12 July, 1893.

As it is deemed desirable to procure some reliable information as to the best method and time for ringbarking and destroying useless timber, I have to request that you will be good enough to furnish any information you may have gained under the following heads:—

1. At what time of the year the ringbarking or sapping proves most effective.
2. At what time ineffective.
3. The kind of timber that is most easily destroyed, and the kind that is the reverse.
4. Whether you consider trees should be sapped or simply ringbarked.

Also any other information that may be useful to the Department, especially the effect of ringbarking on the grasses.

W. S. CAMPBELL
(For the Under Secretary).

It was addressed to all foresters, from the greater number of whom replies, more or less full, have been received.

In the answers to the several questions I have interfered with the wording of the replies as little as possible, so that the foresters may use their own words. Even where the reports of several foresters practically amount to the same thing, it is often suggestive to have the position expressed by a different form of words. Where alterations have been made for clearness or compactness' sake, it is chiefly because the replies have been given in some instances in the form of a continuous report, instead of keeping the reply to each question separate from the others.

I have arranged the foresters' districts as far as possible in fairly well-defined climatic groups as follows:—

1. North Coast.
2. Central Coast.
3. South table-land and South Coast.
4. North table-land.
5. Dry plain country mainly.
6. Murrumbidgee and Murray.

Following are the names of the foresters who have reported and their head-quarters.

NORTH COAST.

Foresters.	Head-quarters.
Pope	Murwillumbah.
Huxham	Grafton.
Mecham	Bellinger.
Macdonald	Kempsey.
Brown*...	Port Macquarie.
Angus Kennedy	"
J. McLennan	"
J. Downes...	"
Rudder	Booral.

* Mr. Angus Kennedy, Mr. J. McLennan, and Mr. J. Downes, in this forester's district, have also been kind enough to furnish information on the subject, and their replies will be found in the proper place.

CENTRAL COAST.

Cobcroft (not actually touching coast)	Singleton.
Brunker, assistant	Ellalong.
Martin	Gosford.
Stopford (part)	Penrith.

SOUTH TABLE-LAND AND SOUTH COAST.

Rotton	Picton.
Allan	Milton.
Benson	Bega.
Jennings, assistant	Queanbeyan.

NORTH TABLE-LAND.

Crowley	Casino.
Deverell	Glen Innes.
Siddins	Armidale.
Kingsford	Gunnedah.
Marriott	Mudgee.
Stopford (part)	Penrith.

DRY PLAIN-COUNTRY MAINLY.

McGee	Narrabri.
King	Coonamble.
Smith	Dubbo.
Kidston...	Condobolin.
Postlethwaite, assistant	Grenfell.
Taylor	Wagga Wagga.
Martin	Dubbo.

Mr. Martin was forester at Dubbo at the time he obtained the information which he has supplied in regard to western timbers. He is now stationed at Gosford.

MURRUMBIDGEE AND MURRAY.

Manton, inspecting	Moama.
Condell	Narrandera.
Wilshire	Deniliquin.
Chanter...	Koondrook.
Guilfoyle	Moama.
Payten	Corowa.

Following are the replies:—

1. At what time of the year the ringbarking or sapping proves most effective.

NORTH COAST.

Forester Pope, Murwillumbah.—August to December, "when the sap is up."

Forester Huxham, Grafton.—Midsummer is the most effective time for sapping trees.

Forester Mecham, Bellingen.—End of January to not later than the end of March.

Forester Macdonald, Kempsey.—It seems reasonable to suppose that ringbarking should prove most effective in the spring when the sap is in full circulation, and the tree bearing its best foliage, but much depends on climatic conditions, and the kinds of timber to be dealt with. In this North Coast District, where there is generally a great variety of timbers (mixed), and all coming under the operation of the axe at the same time, no definite rule can be laid down which would apply to all districts, and prove to be an unexceptionable guide. The most effective ringbarking that I have seen in this district was performed in the autumn, or between the 1st of February and the 30th of April, after a wet summer. One advantage of ringbarking at this time of the year is that any suckers which may shoot from the stumps have not time to gather sufficient strength to withstand the frosts of June and July.

Forester Brown, Port Macquarie.—When the tree is full of sap, and just before it starts to come down. I might instance a case of ringbarking, contradicting the general opinion as to certain definite months for ringbarking, *e.g.*, on "Yarras" Station on the Hastings River, 45 miles from here; with ridgy, undulating, and flat country; timber, gum, box, stringy bark, and apple tree, &c.; operated on at all seasons, as the chance came of men travelling for work; no suckers grew; this was principally ringbarked; about 4 to 6 inches of the bark off all round the tree. The soil is light red, and abundance of a sort of slaty gravel on the ridges with the wash on the flats; the grasses on this station are considered excellent, yet all the timber has been rung.

Mr. Angus Kennedy, Port Macquarie.—December and January. When done in these months the trees will mostly sprout in March; the sprouts will then be weakly when the frost comes on, and they seldom grow the following year.

Mr. J. M'Lennan, Yarras, Port Macquarie District.—During the summer months nearly all our forest trees have the sap up (except bloodwood and tallow-wood, which blossom in winter). If then ringbarked 3 inches wide and ½ inch deep, they will die quickly and not throw up suckers; sapping not needed.

Mr. Downes, Rawdon Island, Port Macquarie District.—March, April, May.

Forester Rudder, Booral.—A great deal depends on the season, whether wet or dry. Generally speaking, the best time is when the sap is well up. There are first-class results of ringbarking near here, done in March; the trees are all dead, and there is no suckering.

Central Coast.

Forester Cobcroft, Singleton.—October.

Forester Martin, Gosford.—June, July, and August. It is thought by many persons that ringbarking operations should only be performed when the sap is either up or down. This, I think, is only partially correct, as the circulation of sap in a tree is always going on more or less, and it is made active after a day's soaking rain in any month of the year.

Forester Stopford, Penrith.—February.

South Table-land and South Coast.

Forester Rotton, Picton.—Ringbarking or sapping proves most effective when the sap is up, in the months of November, December, January, February, March, and the beginning of April.

Forester Allen, Milton.—January and February in coast districts. Should it be a wet season, the trees die well, and are not followed by any second growth. July and August in the Jingera and Monaro districts, according to local residents.

Forester Benson, Bega.—End of February. The forest growth has pretty well ended in February in this district.

Forester Harris, Queanbeyan.—About the end of summer, "when the sap is well up." It is difficult to define any exact month in the year for ringbarking, as it must depend a good deal on the seasons, and also on the kind of country to be rung, and it must be remembered that ringbarking is always more effective after a shower of rain. Experience alone will suggest the proper time to ringbark.

North Table-land

Forester Crowley, Casino.—Beginning of December, in hilly or ridgy country, to end of April. Near the coast in flat country the timber should be ringbarked from April to August.

Forester Deverell, Glen Innes.—As regards what time of year best to ring, I must say that no set month or regular time can be stated, as it mostly, as far as my experience goes, depends on the season and soil, *i.e.*, it must be done when the sap is up, which occurs generally on good soils in the eastern parts about January or February, and in bad soils even later; while in the western part about a couple of months earlier, viz., November or December.

Forester Siddins, Armidale.—I have always found ringbarking most effective when the sap is up, which occurs after heavy rains, when the operation can be performed with the certainty of the trees dying without producing suckers. It is particularly effective when rains fall from the middle of spring to the middle or end of the autumn.

Forester Kingsford, Gunnedah.—During the late summer months, February and March, when the sap is up. Some persons consider that the winter months, July and August, are best for the purpose, the sap then being "down"; but, in this latter case, the stump is liable to "sucker" at and below the ring when the sap again commences to ascend. In any case I do not consider it prudent to operate in any months, other than those stated, during which the sap is in circulation, the work of killing the trees being thus rendered more difficult.

Forester Marriott, Mudgee.—Early autumn during the months of February, March, and April, when the sap is at its height, and the work of flowering and fruiting is over. As, however, different trees vary in their periods of flowering, this cannot be laid down as a general rule; it is necessary when ringbarking a stretch of country—if it is to be effectively carried out—to notice this difference, and not ringbark promiscuously. Latitude and altitude also bear upon the latter point.

Dry Plain Country Mainly.

Forester M'Gee, Narrabri.—The best time of the year to ringbark or sap trees is during the spring and summer months when the sap is up, particularly after rain, at which time sap is most abundant.

Forester King, Coonamble.—May or June, as, if the trees should throw out suckers, their growth would be checked during the summer months.

Forester Kidston, Condobolin.—December and January, unless they are wet.

Assistant-Forester Postlethwaite, Grenfell.—December, January, February. Suckers will generally put out in six or eight months, and if done in summer have another summer to contend against, and being small and weak the hot sun will frequently scorch and kill them before gaining strength, but if rung in the winter they have the whole of the following winter to mature.

Forester Taylor, Wagga Wagga.—As early in the autumn as possible.

Murrumbidgee and Murray.

Inspecting-Forester Manton, Moama.—The summer.

Forester Condell, Narrandera.—November, December, January, when the sap is well up in the timber.

Forester Wilshire, Deniliquin.—October to March, the sap being then well up.

Forester Payten, Corowa.—March, April, May, June, July. I have noticed that red-gum trees when sapped during the latter end of March die out and but few suckers appear, though trees sapped in March cause the land to be strewn with dead timber shortly after, consequent upon the flow of sap in the trees at that time, which hastens decay, and trees rung in the winter when the sap is less active cause the trees to linger for, say, twelve months before they die.

Forester Guilfoyle, Moama.—January, February, and the greater part of March. It is always better to wait till the new growth of the tree has made some progress. By ringbarking at that period the check will be greater than if the work is done immediately after the new growth commences. The evaporation from the foliage of such trees as red-gum and box is much greater after the new growth has made some headway than at starting, and consequently the more severe the check to the vitality of the tree when the sap current is broken. It must be borne in mind that in dealing with this most important matter of ringbarking, local conditions of climate and kind of tree should always receive due consideration. Fifty or sixty miles up or down the Murray from any given point might possibly be a different climate, so that some judgment in regard to the exact time to begin ringbarking or thinning is absolutely necessary. It means simply to watch for the time when the bark strips freely, and then to go to work as rapidly as possible.

The information contained in the foregoing replies will be clearer if the months recommended for ringbarking are put in tabular form :—

Forester.	Head Quarters.	Months recommended.
		North Coast.
Pope	Murwillumbah	August to December.
Huxham	Grafton	January.
Mecham	Bellingen	January 31 to March 31 (at latest).
Macdonald	Kempsey	February 1 to April 30.
Brown	Port Macquarie	
Angus Kennedy	,,	December, January.
J. McLennan	,, (Yarras.)	Summer months.
Downes	Port Macquarie (Rawdon Id.)	March, April, May.
Rudder	Booral	When sap well up ; March, &c.
		Central Coast.
Cobcroft	Singleton	October.
Martin	Gosford	June, July, August.
Stopford	Penrith	February.
		South Table-land and South Coast.
Rotton	Picton	November to end of March.
Allan	Milton	January, February (for Coast); July, August (Jingera and Monaro).
Benson	Bega	End of February.
Harris	Queanbeyan	End of summer.
		North Table-land.
Crowley	Casino	December to end of April (hilly country); April to August (flat coast lands).
Deverell	Glen Innes	January, February (eastern slope); November, December (western slope).
Siddins	Armidale	Middle of spring to middle or end of autumn.
Kingsford	Gunnedah	February, March.
Marriott	Mudgee	February, March, April.
		Dry Plain Country Mainly.
McGee	Narrabri	Spring and summer.
King	Coonamble	May, June.
Kidston	Condobolin	December, January.
Postlethwaite	Grenfell	December, January, February.
Taylor	Wagga Wagga	Early autumn.
		Murrumbidgee and Murray.
Manton	Moama	Summer.
Condell	Narrandera	November, December, January.
Willshire	Deniliquin	October to March.
Payten	Corowa	March to July.
Guilfoyle	Moama	January, February, March.

From perusal of this table it is at once seen that no one month, or series of months,* is best for ringbarking in all seasons and in all parts of the Colony. This point is emphasised by most of the foresters, some of whom point out the necessity for noting local experience. This is, of course, the truest guide, as a general rule. Speaking generally, it is recommended, almost without exception, to ringbark when the sap is up, for the reasons stated in slightly different language by different foresters. As one forester puts it, "Watch for the time when the bark strips freely, and then go to work as rapidly as possible."

Months recommended for ringbarking.

Months.	North Coast.	Central Coast.	South Table-land and South Coast.	North Table-land.	Dry plain country mainly.	Murrumbidgee and Murray.	Total "votes."
January ...	3	......	2	3	3	4	15
February ...	3	1	4	5	2	3	18
March	4	......	1	4	1	3	13
April	2	......	......	4	......	1	7
May	1	......	......	1	1	1	4
June	......	1	......	1	1	1	4
July	......	1	1	1	......	1	4
August... ...	1	1	1	1	......	......	4
September ...	1	......	......	......	1	......	2
October ...	1	1	......	1	1	1	5
November ...	1	......	1	2	1	2	7
December ...	3	......	1	3	3	3	13

Explanatory.—In compiling the above statement, spring has been interpreted to mean September to November; summer, December to February; autumn, March to June.

Taking the Colony as a whole, it will be observed that the months most recommended for ringbarking are from December to March, while February is preferred. The numbers in the columns show the number of "votes" given per district for each month, so that the desirability or not of ringbarking in any particular district during any month may be at once seen.

2. At what time ineffective?

The answers are, in the main, the converse of those given in reply to No. 1, so they need not be tabulated or discussed at length. The general opinion is that ringbarking is inexpedient in the winter months.

North Coast.

Forester Huxham, Grafton.—Winter.

Forester Mecham, Bellingen.—Ineffective so far during the winter months and when the sap is rising, when, if ringbarked, suckers grow from the stump and roots, causing a heavy undergrowth.

Forester Macdonald, Kempsey.—The time at which the operation would generally prove most ineffective is in midwinter or the dry season, when there is a partial suspension of the sap, and the chief vitality of the tree is in the root. The reason is obvious. If the operation is performed at such a time, the root and stump of the tree being in full vigour, it has a powerful

* If it is absolutely necessary to give a season, summer is the best.

tendency (with the rising of the sap) to throw out a new growth in the form of suckers, the destruction of which often costs far more than the ringbarking.

Forester Brown, Port Macquarie.—I have not observed.

Mr. Angus Kennedy, Port Macquarie.—Early in the season (spring), because the sprouts then grow strong and able to withstand the frost the following winter.

Forester Rudder, Booral.—Generally the dry time. When the sap is down.

Central Coast.

Forester Cobcroft, Singleton.—Nil.

Forester Martin, Gosford.—Spring and summer months. This also expresses the result of Mr. Martin's experience at Dubbo.

Forester Stopford, Penrith.—July or August.

South Table-land and South Coast.

Forester Rotton, Picton.—When the sap is down, in the months of May, June, July, August, September, and October. I do not say that ringbarking or sapping done in these months will not destroy the trees, but they are almost sure to throw out suckers, and give more trouble than if done the proper season.

Forester Allan, Milton.—Winter months, *i.e.*, when the sap is down. At the same time the sap flows at different periods in the case of different trees.

Forester Benson, Bega.—Winter or spring months. To ring them then is throwing money away. If the land is timbered heavily, suckers will spring up in abundance causing more to eradicate than the ringing.

Forester Harris, Queanbeyan.—Winter.

North Table-land.

Forester Deverell, Glen Innes.—I consider that for all practical purposes it is ineffective to ringbark or sap during the winter months, first because it takes a long time to kill, if ever, and secondly because it generally produces suckers, especially in this district with stringybark and box.

Forester Siddins, Armidale.—It is not effective during the winter as a rule, or a drought, or when the sap is down, as on its rising suckers are forced out below the cut, and these are extremely difficult to destroy.

Forester Marriott, Mudgee.—During the spring and early summer, when the trees are making fresh wood.

Dry Plain Country Mainly.

Forester McGee, Narrabri.—The winter months generally prove unsatisfactory for sapping or ringbarking, as the sap is all down in the roots of the trees then. When the sap rises in the spring it cannot get further than the ring, and consequently throws out suckers all round the tree. The tree dies, but the suckers flourish and are as much trouble to kill as the tree. During moist and wet seasons trees ringbarked or sapped frequently throw out suckers more or less, as sap is then plentiful.

Forester King, Coonamble.—During the hot weather. It is probable the shoots would grow very rapidly during the winter months, especially if a wet season ensues.

Forester Kidston, Condobolin.—After heavy rain, followed by warm weather.

Assistant-Forester Postlethwaite, Grenfell.—July, August.

Forester Taylor, Wagga Wagga.—In the spring.

MURRUMBIDGEE AND MURRAY.

Inspecting-Forester Manton, Moama.—In the winter.

Forester Condell, Narrandera.—Winter and spring months. Trees ringbarked during these months throw out suckers and shoots, as the sap rises to where the tree has been rung.

Forester Wilshire, Deniliquin.—The autumn and winter months.

Forester Payten, Corowa.—Sap-ringing would be effective at any time, only if done during spring or summer the trees would throw out suckers, thereby causing the work to be done over again, and if the trees are ringbarked during that period, and wet weather sets in, it would in many cases cause the sap to unite.

Forester Guilfoyle, Moama.—The ringbarking or sapping of "red gum" (*Eucalyptus rostrata*), or "box gum" (*E. hemiphloia*), two of our very best timbers, should by no means ever be attempted in the winter season, for the simple reason that the sap at that time is not in an active state, or what bushmen call "up." The work would be useless, to say the least of it.

3. The kind of timber that is most easily destroyed and the kind that is the reverse.

This is a very important question, and, after the replies have been read, it will be found necessary to examine the tabulated forms and brief summaries at the end, in order to grasp the replies. While there is little or no doubt as to the facility (or the reverse), with which certain trees may be killed by ringbarking or sapping, one must be careful not to generalise too much upon the data before us. There is great diversity as to the number of trees referred to by individual foresters. Some foresters have hardly specified a single tree, while others have named a good many. It is obvious, therefore, in counting the "votes" as to whether a certain species of tree is easy or difficult to kill, the trees referred to by foresters who have supplied long lists will monopolise the votes. The only way to exhaustively ascertain whether certain timbers are easy to kill, or the reverse, would have been to have requested each forester to report upon twenty specified trees, but, as it is, a good deal of valuable information has been secured.

In some instances it has not been possible to give the scientific name with absolute certainty (owing to non-receipt of flowers and fruit); in these cases it has been omitted, or a query put in front of the name. These botanical names have been given wherever possible, in order to properly define the trees referred to, as local names are often vague. In a few instances the replies might well have been a little fuller, but, taking them as a whole, they impart useful information.

NORTH COAST.

Forester Pope, Murwillumbah.—Easiest: All kinds of timber (except stringybark) are on an equality as regards destruction by ringbarking. Most difficult: Stringybark (*Eucalyptus acmenoides*).*

*[NOTE.—This tree is usually known as white mahogany, but it has a fibrous bark, hence the name of stringybark in the district. Fruits of the tree referred to have been received from Mr. Pope.]

Forester Huxham, Grafton.—Easiest: All our forest timbers. Most difficult: Soft brush timbers.

Forester Mecham, Bellingen.—Easiest: Turpentine (*Syncarpia laurifolia*); gum (the smooth-barked eucalypts); ironbark (*Eucalyptus paniculata*); blackbutt (*Eucalyptus pilularis*); tallow-wood (*Eucalyptus microcorys*); grey gum (*Eucalyptus saligna var.*); white mahogany (*Eucalyptus acmenoides*); red mahogany (*Eucalyptus resinifera*). Most difficult: Brush or white box (*Tristania conferta*); forest oak (*Casuarina suberosa* mainly); bloodwood (*Eucalyptus corymbosa*); these require heavy sapping to ensure success.

Forester MacDonald, Kempsey.—Easiest: Apple-tree (*Angophora subvelutina*); ironbark (*Eucalyptus paniculata*); forest oak (*Casuarina torulosa*); stringybark (*Eucalyptus eugenioides*). Most difficult: Blackbutt (*Eucalyptus pilularis*); spotted gum (*Eucalyptus maculata*); grey gum (*Eucalyptus saligna* and *tereticornis*).

Forester Brown, Port Macquarie.—Easiest: Stringybark (*Eucalyptus eugenioides*); mahogany (*Eucalyptus resinifera*); stinking or broad-leaf gum (*Eucalyptus sp.*) (It will be observed that the experience of Mr. Forester Brown and Mr. J. McLennan do not agree as regards the stinking or broad-leaf gum.)

J. McLennan, Yarras.—Easiest: Stringybark (*Eucalyptus eugenioides*); grey box (*Eucalyptus hemiphloia*); ironbark (*Eucalyptus paniculata, &c.*); forest oak (*Casuarina torulosa*); bloodwood (*Eucalyptus corymbosa*); tallow-wood (*Eucalyptus microcorys*); red or scrub box (*Tristania conferta*); blue gum (*Eucalyptus saligna*). Most difficult: White or ribbon gum (*Eucalyptus viminalis*); broad-leaf or stinking gum (*Eucalyptus sp.*)

Angus Kennedy, Port Macquarie.—Easiest: Ironbark (*Eucalyptus paniculata*); box (*Eucalyptus hemiphloia*); apple (*Angophora subvelutina*); grey gum (*Eucalyptus tereticornis*). Most difficult: Stringybark (*Eucalyptus eugenioides*); blue gum (*Eucalyptus saligna*); flooded gum (*Eucalyptus saligna*).

Forester Rudder, Booral.—Easiest: Bloodwood (*Eucalyptus corymbosa*); ironbarks (*Eucalyptus paniculata, siderophloia, &c.*); blue gum (*Eucalyptus saligna*); flooded gum (*Eucalyptus saligna*); grey gum (*Eucalyptus saligna var.*); turpentine (*Syncarpia laurifolia*); red mahogany (*Eucalyptus resinifera*); stringybarks (*Eucalyptus eugenioides* and *macrorrhyncha*); tallow-wood (*Eucalyptus microcorys*); river oak (*Casuarina Cunninghamiana*); forest oak (*Casuarina torulosa*). Most difficult: Brush box (*Tristania conferta*); tea-trees (*Melaleuca spp.*); swamp oaks, viz., forest swamp oak (*Casuarina glauca*), and coast swamp oak (*Casuarina stricta, quadrivalvis*); spotted gum (*Eucalyptus maculata*); red gum (*Eucalyptus tereticornis*); grey box (*Eucalyptus hemiphloia*). These are usually hard to kill, or sucker a good deal. Brush or scrub trees are very deep in the sap, and are mostly hard to kill.

Central Coast.

Forester Cobcroft, Singleton.—Easiest: Ironbark (*Eucalyptus crebra, &c.*); box (*Eucalyptus hemiphloia*). Most difficult: Tea-tree (*Melaleuca spp.*).

Forester Martin, Gosford.—Easiest: Box (*Eucalyptus hemiphloia*); apple (*Angophora lanceolata*); blackbutt (*Eucalyptus pilularis*); stringybark (*Eucalyptus eugenioides*); ironbark (*Eucalyptus paniculata, &c.*); blue gum (*Eucalyptus saligna*); red gum (*Eucalyptus tereticornis*); grey gum

(*Eucalyptus tereticornis*). Most difficult: Flooded gum (*Eucalyptus saligna*); mahogany (*Eucalyptus resinifera*); spotted gum (*Eucalyptus maculata*).

South Table-land and South Coast.

Forester Rotton, Picton.—Easiest: All. Most difficult: Red box (*Eucalyptus polyanthema*) (?); peppermint (*Eucalyptus piperita*); bangallay (*Eucalyptus botryoides*); blue gum (*Eucalyptus saligna*); grey gum (*Eucalyptus tereticornis*); white box (*Eucalyptus hemiphloia*).

Forester Allan, Milton.—Easiest: Nearly all our eucalypts, and the majority of brush trees. Most difficult: Fig (*Ficus rubiginosa*); stinging-tree (*Laportea gigas* and *L. photiniphylla*); kurrajong (*Sterculia diversifolia*).

Forester Benson, Bega.—Easiest: Not stated. Most difficult: Peppermint (*Eucalyptus piperita*); black box (*Eucalyptus longifolia* (?); stringybark (*Eucalyptus eugenioides*); as they throw more suckers than other kinds of timber. [The black box of this district is known as woollybutt in other parts of the Colony.]

Forester Harris, Queanbeyan.—Most easily: Gum (*Eucalyptus*, smooth barked species); apple (*Eucalyptus stuartiana*), stringybark (*Eucalyptus macrorrhyncha*); box (*Eucalyptus hemiphloia*); in the order named. Most difficult: Peppermint or messmate (*Eucalyptus amygdalina, var.*) is the hardest tree of all to kill, on account of the innumerable suckers that appear; it should be rung at a different time, viz., winter.

North Table-land.

Forester Crowley, Casino.—Easiest: Ironbark (*Eucalyptus siderophloia*); red gum (*Eucalyptus tereticornis*); bloodwood (*Eucalyptus corymbosa*); apple-tree (*Angophora subvelutina*); oaks (*Casuarina spp.*). Most difficult: Spotted gum (*Eucalyptus maculata*); blackbutt (*Eucalyptus pilularis*); tallow-wood (*Eucalyptus microcorys*); stringybark (*Eucalyptus eugenioides*); tea-tree (*Melaleuca spp.*); dogwood (? *Jacksonia scoparia*).

Forester Deverell, Glen Innes.—Easiest: Not stated. Most difficult: Narrow-leaf ironbark (*Eucalyptus crebra*); bimbil box (*Eucalyptus populifolia*).

Forester Siddins, Armidale.—Easiest: Red gum (*Eucalyptus tereticornis*); white gum (*Eucalyptus pauciflora*); red peppermint (*Eucalyptus sp.*); white peppermint (*Eucalyptus acmenoides?*); apple-tree (*Eucalyptus stuartiana*); honeysuckle (*Banksia integrifolia*); stringybark (*Eucalyptus macrorrhyncha*) below the Eastern Falls; bloodwood (*Eucalyptus corymbosa*); ironbark (*Eucalyptus crebra, &c.*) Most difficult: Stringybark (*Eucalyptus macrorrhyncha*) on the table-land; white box (*Eucalyptus hemiphloia*); yellow box (*Eucalyptus melliodora*); black sally (*Eucalyptus stellulata*); narrow-leaf peppermint (*Eucalyptus piperita?*); and nearly all young timber of the above-named sorts.

Forester Kingsford, Gunnedah.—Easiest: Apple-tree (*Angophora subvelutina*). Most difficult: Gums (*Eucalyptus*, smooth-barked species); forest oak (*Casuarina torulosa*).

Forester Mariott, Mudgee.—Easiest: Apple-tree (*Eucalyptus stuartiana*) and gum fully grown, and mature timber, and all pipy and stunted growths are easily destroyed. Most difficult: Box-trees of all kinds (*Eucalyptus hemiphloia, melliodora, &c.*), and young trees full of life; saplings and trees that have suckered are the reverse.

DRY PLAIN COUNTRY MAINLY.

Forester McGee, Narrabri.—Most easily: Pine *(Frenela endlicheri* and *robusta)*; oak and belar* (*Casuarina*); ironbark (*Eucalyptus crebra*); box (*Eucalyptus hemiphloia*). Most difficult: Gum of all kinds (*Eucalyptus*, smooth-barked); bibble box (*Eucalyptus populifolia*); budda (*Eremophila Mitchelli*); brigalow (*Acacia harpophylla*); swamp box (*Eucalyptus largiflorens*?).

Forester King, Coonamble.—Easiest: Pine (*Frenela endlicheri* and *robusta*); bull oak (*Casuarina glauca*?); belar (*Casuarina glauca*); yarran (*Acacia homalophylla*); wilga (*Geijera parviflora*). Most difficult: White box (*Eucalyptus hemiphloia*); yellow box (*Eucalyptus melliodora*); blue gum (*Eucalyptus viminalis*?); red gum (*Eucalyptus rostrata*); ironbark (*Eucalyptus sideroxylon*); apple-tree (*Eucalyptus stuartiana*?); budda (*Eremophila mitchelli*).

Forester Martin, late of Dubbo.—Easiest: Coolybar (*Eucalyptus microtheca*); belar (*Casuarina glauca*): bimble (*Eucalyptus populifolia*); pine (*Frenela endlicheri* and *robusta*). Most difficult: budda (*Eremophila mitchelli*).

Forester Kidston, Condobolin.—Easiest: Pine (*Frenela endlicheri* and *robusta*); bull oak and belar (*Casuarina glauca, &c.*). Most difficult: Box of all kinds (*Eucalyptus hemiphloia, melliodora, microtheca, largiflorens, &c.*).

Assistant-Forester Postlethwaite, Grenfell.—Easiest: Pine (*Frenela endlicheri* and *robusta*); belah (*Casuarina*); yarran (*Acacia homalophylla*). These never put out suckers. Bull oak (*Casuarina*) very seldom, and if suckers do sprout they soon die. Then ironbark (*Eucalyptus sideroxylon*); white box (*Eucalyptus hemiphloia*); apple (*Eucalyptus stuartiana*?); stringybark (*Eucalyptus macrorrhyncha*); yellow box (*Eucalyptus melliodora*); red gum (*Eucalyptus rostrata*) in the order named. Ironbark (*Eucalyptus sideroxylon*) in the Burrowa and Frogmore districts puts out very few suckers, but in the Grenfell, Temora, and Cootamundra districts this is reversed, and suckers grow plentifully. I cannot assign a reason for this, except that it may be that the former places have a cooler climate than the latter.

Forester Taylor, Wagga Wagga.—Easiest: All the pine family (*Frenela robusta* and *endlicheri*), as they do not sucker, if cut below the bottom limb. All the oak or belah family (*Casuarina glauca, &c.*), as they do not sucker freely, and then the stock eat them off before they have time to grow to any size. Nearly all the myall family (*Acacia pendula, &c.*) They are sapless, both root and branch, and will not sucker. Flooded gum (*Eucalyptus rostrata*), it suckers, but not to any great extent. Ironbark *Eucalyptus sideroxylon*), suckers, but not freely. Messmate *Eucalyptus amygdalina, var.*), is hardest of all to destroy; it suckers very freely, both from the trunk above ground, as well as from the knots near the surface, on the roots, right to their extremities. All the box family:—White box (*Eucalyptus hemiphloia, var.*); red box (*Eucalyptus polyanthema*); blue or grey box (*Eucalyptus hemiphloia*); bimbil (*Eucalyptus populifolia*), and especially

*At present it will be sufficient to refer to oak, bull oak, and belar as *Casuarina*, without defining the species, in instances in which botanical material has not been sent for that purpose. Most of the trees known as bull oak are *Casuarina glauca*; at the same time the name sometimes includes *C. equisetifolia* var. *incana*. Again, belar is often a fine-leaved form of *C. glauca*; but it sometimes includes *C. Cunninghamiana*, *C. equisetifolia*, and *C. lepidophloia*. Cones and twigs of the various trees known as bull oak and belar in different parts of the Colony would be acceptable, for the nomenclature could be readily settled if the necessary material were available.

yellow (*Eucalyptus melliodora*). These are hard to destroy by ringbarking. They all sucker freely, and if allowed to remain for three or four years the grass becomes less every year, and the end is far worse than the commencement. White-ribbon gum (*Eucalyptus viminalis ?*); cabbage gum (*Eucalyptus pauciflora*); black sally (*Eucalyptus stellulata ?*); all sucker freely, but are much easier got rid of than the box family.

Murrumbidgee and Murray.

Inspecting-Forester Manton, Moama. **Easiest**: Brush or scrub trees—conifers (*Frenela robusta* and *endlicheri*); casuarineæ (*Casuarina spp.*) Most difficult: Eucalypts—red gum (*E. rostrata*); white box (*E. hemiphloia, &c.*).

Forester Condell, Narrandera.—Easiest: Pine (*Frenela endlicheri* and *robusta*); yarran (*Acacia homalophylla*); boree (*Acacia pendula*). Most difficult: Box of different sorts (*Eucalyptus hemiphloia, melliodora, &c.*); oaks, various (*Casuarina spp.*); wattles, various (*Acacia spp.*). These timbers are very difficult to destroy, as they are constantly throwing out shoots if not rung at the proper season.

Forester Wilshire, Deniliquin.—Easiest: Murray pine (*Frenela robusta*); belar, or oak (*Casuarina glauca ?*). Most difficult: Red gum (*Eucalyptus rostrata*); flooded or black box (*Eucalyptus hemiphloia*).

Forester Guilfoyle, Moama.—Easiest: With regard to the Murray pine (*Frenela robusta*), it hardly matters at what season of the year it is operated upon, because, like all species of the cypress tribe, it exudes gum or resin when cut into, and is therefore easily killed.

Forester Payten, Corowa.—Easiest: Pine (*Frenela robusta*); oak (*Casuarina*); box (*Eucalyptus hemiphloia*); the pine especially, as this timber does not throw out any suckers. Most difficult: Red gum (*Eucalyptus rostrata*).

The foregoing information is tabulated herewith:—

Eucalypts.—*Easiest.*

Common Name.	Botanical Name.	Number of Votes.
Gum*	Eucalyptus sp.	3
Blue gum	,, saligna	9
Flooded gum	,, ,,	
Grey gum	,, ,, var.	
Grey or red gum	,, tereticornis	6
Red or flooded gum	,, rostrata	3
White gum	,, pauciflora	3
Stinking or broad-leaf gum	,, ...	2
Box, white or grey box	,, hemiphloia	10
Yellow box	,, melliodora	2
Bimble box	,, populifolia	2
Coolybar	,, microtheca	2
Red or forest mahogany	,, resinifera	4
White mahogany and stringybark	,, acmenoides	3
White peppermint	,, ,,	2
Red peppermint	,, ...	2
Apple	,, stuartiana	5
Bloodwood	,, corymbosa	4
Tallow-wood	,, microcorys	4
Blackbutt	,, pilularis	3
Stringybarks	,, eugenioides and macrorrhyncha	7
Ironbarks	,, paniculata and others	13

* The name gum is generally applied to the smooth barked species of Eucalyptus.

EUCALYPTS.—*Most difficult.*

Common Name.	Botanical Name.*	Number of Votes.
Box	Eucalyptus sp.	3
Box, white or grey box	,, hemiphloia	9
Yellow box	,, melliodora	5
Red box	,, polyanthema	3
Bible or bimble box	,, populifolia	3
Swamp box	,, largiflorens	1
Flooded or black box	,, ,, and hemiphloia	2
Black box*	,, longifolia	1
Mahogany	,, resinifera	1
Bangallay or bastard mahogany	,, botryoides	1
Apple	,, stuartiana	1
Bloodwood	,, corymbosa	1
Tallow-wood	,, microcorys	1
Gum	,, species	2
Blue gum	,, saligna	
Flooded gum	,, ,,	5
Grey gum	,, ,,	
,,	,, tereticornis	3
Red gum	,, ,,	
,,	,, rostrata	4
White-ribbon gum	,, hæmastoma (?)	1
Cabbage gum	,, pauciflora	1
Blue gum or white gum	,, viminalis	2
Spotted gum	,, maculata	4
Broad leaf or stinking gum	,,	1
Peppermint	,, piperita	2
Narrow-leaf peppermint	,, ,,	1
Peppermint or messmate	,, amygdalina var.	2
Blackbutt	,, pilularis	2
Stringybark	,, eugenioides and macrorrhyncha, &c.	5
Black sally	,, stellulata	2
Ironbark	,, crebra and sideroxylon	2

* Usually known as woollybutt.

Easiest, by a large majority: Blue gum, flooded gum (*Eucalyptus saligna*), grey and red gum (*Eucalyptus tereticornis*), mahogany of sorts, apple (*Eucalyptus stuartiana*), bloodwood, tallow-wood, stringybarks, ironbarks.

Practically equal division of opinion: Red or flooded gum (*Eucalyptus rostrata*), white and cabbage gum, peppermint, blackbutt.

Most difficult (*by a large majority*): Box of all kinds.

Most difficult (*unanimous opinion*): Spotted gum, black sally.

NON-EUCALYPTS—*Easiest.*

Common Name.	Botanical Name.	Number of Votes.
Apple-tree	Angophora subvelutina	5
,,	,, lanceolata	2
Turpentine	Syncarpia laurifolia	3
Red or scrub box	Tristania conferta	2
Oaks in general	Casuarina species	4
Belar or bull oak	,, glauca, &c.	13
River oak	,, Cunninghamiana	2
Forest oak	,, torulosa and suberosa	3
Yarran	Acacia homalophylla	4
Myall	,, pendula	4
Pine	Frenela endlicheri and robusta	12
Wilga	Geijera parviflora	2
Honeysuckle	Banksia integrifolia	2

NON-EUCALYPTS—*Most difficult.*

Common Name.	Botanical Name.	Number of Votes.
Tea-trees	Melaleuca	3
Brush or white-box...	Tristania conferta	2
Oaks	Casuarina	1
Forest oak	,, torulosa	2
Forest swamp oak	,, glauca	1
Coast swamp oak	,, stricta	1
Wattles	Acacia	1
Brigalow	,, harpophylla	1
Budda	Eremophila mitchelli	3
Black-bean	Castanospermum australe	1
Fig	Ficus rubiginosa.........	1
Kurrajong	Sterculia diversifolia	1
Stinging-tree...	Laportea	1
Dogwood	Jacksonia scoparia	1
Native ebony	....	1

SUMMARY.

Easiest (*unanimous opinion*) :—Apple (*Angophora*), turpentine, yarran, myall, pine, wilga, honeysuckle.

By large majority :—Oaks (*Casuarina*).

Most difficult (*unanimous opinion*) :—Tea-trees, budda.

Equal division of opinion :—Brush box.

NOTE.—Timbers receiving less than two votes have not been referred to in the summary.

4. Whether you consider trees should be sapped or simply ringbarked.

It will be seen that the opinions in favour of sapping and ringbarking are practically identical. The actual numbers are :—

In favour of sapping	15
In favour of ringbarking	15
Those who are uncertain, or who give uncertain replies	3
Total	33

Nor are the foresters in practically the same climatic districts unanimous as to the best methods of destroying trees. We must, therefore, wait for further evidence on the subject.

I have tabulated the most obvious advantages and disadvantages of the two methods of destroying tree-life, though, doubtless, other items might be added.

Saplings should either be rooted up or denuded of their bark, but never chopped down, as that, or careless ringing, will invariably produce an abundant growth of suckers, as pointed out by Forester Macdonald. Most of the foresters' replies to this question will be found to convey useful information.

Ringbarking—Advantages.

1. Comparative immunity from suckers.

Ringbarking—Disadvantages.

1. Length of time in killing the tree.
2. Not effective with all trees.
3. More or less uncertainty, as a strip of undisturbed bark, inadvertently left, may be sufficient to continue the life of the tree.

Sapping—Advantages.

1. Rapidity of death of tree.
2. Grass comes sooner.

Sapping—Disadvantages.

1. Liability to suckers.
2. When the trees are hollow there is increased danger of their falling.
3. Greater crop of seedlings.
4. Often covers the ground with leaves and twigs.

NORTH COAST.

Forester Pope, Murwillumbah.—If the trees are simply ringbarked they will take longer to die, but the probability is that no suckers will follow, or only a few, whereas, if sapped, they die immediately—in a few weeks, or, if the weather is dry, in a few days. But another evil appears in the shape of thousands of suckers, which spring from the stump below the ring, and also from the roots and seeds, caused, I presume, by the more sudden check, and the vitality of the sap still left below having to find an outlet somewhere. The seeds, also, which have fallen come up more readily if the trees are killed quickly, whereas, in the former case, with the more gradual withering, the seeds are not so much exposed to the sun, and appear to rot with the fallen leaves and twigs. Ringbarking is carried out in forest country alone. I have seen it tried on scrub trees, but without effect. The bark will again grow, and in a year or two cover the wounds.

Forester Huxham, Grafton.—Trees should be sapped.

Forester Mecham, Bellingen.—In my opinion, sapping is most effective, killing the timber very much quicker, and not so likely to sucker. The great difficulty in the North Coast districts is to keep the undergrowth down, and I think that by sapping at the right time of the year a lot of that can be prevented. From my observations the hardest class of country to deal with in the North Coast districts in the destruction of the timber is that known as scrubby forest country, where there is a mixture of all timbers, the country generally being very moist, being at the base of the ridges and along the small creeks.

Forester Macdonald, Kempsey.—The best and most economical method of ringbarking big trees is to simply make a single chop circle round the tree, with a downward pressure of the axe, before withdrawing it, after each cut. This method of a single-cut ring, through bark and sap, makes a good receptacle for the retention of the rainwater, which causes speedy decay of the bark and sapwood so cut, and consequently prevents the formation of new bark, and the growth of suckers from the stump. Saplings should either be taken up by the roots, or simply denuded of their bark, but never chopped down, as that or a careless ringing will invariably produce an abundant growth of suckers.

Forester Brown, Port Macquarie.—I consider sapping is the most effective, if done by cutting through the sapwood, all round, and giving the axe a

wrench outwards before removing it, so that the top of the chop will be clear, with a space in which the rain will lodge, to decay the wood and bark. I also consider that the formation of the country (ridges or flats, &c.), combined with the quality and description of soil, has a great deal to do with the effect of ringbarking on the trees, as to the quantity of suckers, and the length of time the timber is in dying; and that the position of the land, whether facing the sun or not, may make a material difference.

J. M'Lennan, Yarras.—Ringbarking favoured. If ringbarked 3 inches wide, and ½ inch deep, they will die quickly, and not throw up suckers; sapping not needed.

A. Kennedy.—I find that ringbarking does best on open ridges, about 30 or more miles from the coast, and is most difficult to manage on low flat land and near the coast. I find the best method to ring* is to chop with the axe slanting downwards, giving the wood under the bark a jagged surface; if this is done at least, ⅛ of an inch deep, and continued right round the tree, one ring is sufficient and effective on any timber.

J. Downes, Rawdon Island, Port Macquarie District.—I have tried ringbarking in two ways—viz., single chop, and double chop; I find out that the single chop is the best, by wrenching the bark and sap out when releasing the axe. The single chop has many advantages over the double chop, not only is it cheaper, but more effective. There is not so much suckering in single as in double chop, the reason being that, the rain water runs down the tree into the cut, which is half perpendicular and rots the sap and kills the tree above and below the ringing. The double chop is done by chopping a ring round the tree in two chops, top and bottom about 2 inches wide. The top chop is half perpendicular, while the bottom one is horizontal, thus liberating the chip. The horizontal or bottom chop does not disturb the bark, and rain cannot get at the sap, and only kills the tree above the ring. I prefer single chop ringing to sapping.

Forester Rudder, Booral.—The hard-killing trees should, I think, be sapped. Trees sapped often die in a week or two, while ringbarked trees may survive over a year. I am inclined to think that the latter, when the trees die are the least inclined to sucker. Ringbarking will not kill Swamp Oaks.

CENTRAL COAST.

Forester Cobcroft, Singleton.—Ringbarking.

Forester Martin, Gosford.—Ringbarking; a girdle of bark a foot wide, leaving the sap wood clean and bare. Sapping gives the quickest result, but is often attended with suckers, and when the trees are hollow, will cause them to fall. The country suitable for ringbarking is open forest without undergrowth, timbered with box, apple-tree, coolybar, &c. Country thickly timbered with belar is expensive to manipulate, but gives good results; but from scrubby country with poor soil, and timbered principally with ironbark or stringy-bark, poor results may be expected. The following trees should not be ringbarked, as their leaves are eaten by stock in hard times: Myall, yarran, supple jack, leopard-tree, rosewood, mulga, colaine, kurrajong, and quandong.

Forester Stopford, Penrith.—I am of opinion that sapping is a far more certain way of destroying timber of any kind than simply ringbarking.

* Sap.

[NOTE.—The concluding portion refers to Mr. Martin's experience in the western districts.]

South Table-land and South Coast.

Forester Rotton, Picton.—One is as effective as the other, if done carefully at the proper season, but I consider sapping preferable, inasmuch as it kills the timber very much quicker, and the grass comes much sooner. Ringbarking, if possible, should be done in rainy weather, as the bark is then more easily removed, and it should be done most carefully, for if the least piece of bark, either inner or outer, be left, the tree will live. In July, 1886, I remember seeing some flooded gum-trees at Cox's River, which had been ringbarked in June, 1885, and they were still alive, and had no appearance of dying. I noticed that a small portion of the inner bark had been left, and was growing sufficiently to keep the tree alive.

Forester Allan, Milton.—From my own observation, I am inclined to favour ringbarking as against sapping; I have watched both processes. No doubt sapping is very effective, and kills the tree at once, but it covers the ground with *debris*, and the roots keep green for a few years throw out shoots, and seedlings spring up all round. I may inform you that there is a great diversity of opinion amongst settlers as to the best mode of killing trees. Many favour sapping; others ringbarking.

Forester Benson, Bega.—The methods of killing trees are:—(*a*) By cutting through the bark and sap of a tree at a conveuient height for the axeman; this is called sapping; (*b*) Taking a belt of bark from round the tree, about 16 inches wide; (*c*) Cutting through the bark, about 2 feet from the ground, and then stripping the bark down to the ground with the hand. The last two are considered the best methods, as while the trees take longer to die they throw no suckers. Suckers are not the only thing to be considered after ringing has been completed (sapping is probably referred to.—J.H.M.) seedlings will spring up as soon as the timber is killed, and must be looked for and despatched when they are well up. Thousands of pounds are wasted in this district through not attending to the destruction of seedlings, which spring up after the forest timber has been killed, making the land more difficult and costly to clear than it was before any ringing was done. The grass is more plentiful when the trees are ringbarked, and becomes sweeter and more nutritious for stock, and is consequently better for fattening and dairying purposes.

Forester Harris, Queanbeyan.—I consider trees may be simply ringbarked if done at the proper time of year, but the bark should be rung to a width of 9 or 10 inches. If this is done I am of opinion that ringing is far better than sapping.

North Table-land.

Forester Crowley, Casino.—Timber rung in dry seasons dies off much better than if rung in wet ones.

Forester Deverell, Glen Innes.—I think it is quite immaterial whether the trees are ringed or sapped providing they are done at the proper time, but I think if anything ringing is the best and most to be preferred, because it is more effectual in the long run (with the exception of gums, which should be certainly sapped). The branches when dead stand up much longer, though, no doubt, it takes a tree much longer to die when only ringed; but generally it is considered best, as the branches do not fall so early and thus encumber the ground, while when sapped the trees die much quicker, and is, in most cases, just as effective, only that the top branches fall very much quicker. Ringbarking or sapping imperfectly done and not attended to afterwards has the effect of increasing the number of the saplings tenfold, and encourages a growth of timber that cannot be matured; therefore, as this growth only

harbours rabbits and other noxious animals, people so offending ought to be made do it properly. If trees are ringed or sapped at the proper time, and then follows a dry season, it will be found very effective, much more so than if the following be a wet one.

Forester Siddins, Armidale.—I consider that sapping is more effective than ringbarking. The latter can only be done when the bark strips clean, that is, leaving no parts adhering to the sapwood. If it does, the bark will grow over the wound and the tree live. With sapping this danger does not exist, for, if properly done, circulation is completely cut off and cannot be restored. This has been my experience since the year 1862. I may mention that I have found it a mistake to cut too deep into the wood. The thickness of an eggshell of the sapwood being disturbed or removed is quite sufficient to destroy the tree, and suckers are not so likely to be produced. When managing men on whom dependence could be placed, I allowed only one cut around the tree, each blow entering part of the previous one, the wrist being slightly turned, caused the sapwood and bark to open out, forming round the barrel a sort of cut, into which the water collected during rain continually, decomposing the bottom of the wound and preventing suckers from growing. Killing the timber very frequently induces large numbers of seedlings to spring up, the only way to deal with which is to grub them up when they are about 2 feet high.

Forester Kingsford, Lismore.—The practice of ringbarking in this district is carried on to a very limited extent only, its operations being confined almost entirely to some small areas in the western portion, the remainder of the district being characterised by a growth of scrub wood more or less dense. Clearing is done in a face, it being customary to fell everything which comes in the axeman's way during the winter months in order to allow the timber time to dry sufficiently for firing in the summer. In so far as the scrub trees are concerned, I believe they would, in a majority of cases, be easily destroyed by ringbarking; those hardest to kill—black bean, native ebony, &c.—being very useful timbers.

Forester Marriott, Mudgee.—I am of opinion trees should not be sapped, as by so doing the sap is simply driven back to be thrown up elsewhere. In ringbarking, a strip of about 9 inches wide without touching the sap will allow all the sap circulating by means of the sapwood to slowly exude from the tree through the incision, instead of passing in its natural course to the roots, thus slowly and effectually killing the trees.

Dry Plain Country Mainly.

Forester M'Gee, Narrabri.—I consider that trees sapped are more surely killed than if ringbarked, they also die quicker. I am in favour of sapping, although both, at times, prove equally effective. A great deal depends upon the season; if a very dry season, the tree is generally easy to kill, and *vice versa.* Timber growing upon low or swampy country is harder to kill and destroy than timber on hilly or undulating country.

Forester King, Coonamble.—I consider that it is better to sap than simply ring, for the following reasons, viz:—First, if the season is wet, and the timber young and healthy, great care is necessary in the operation of ringing, or else half the trees will not die. Secondly, when timber has been sapped, the trees invariably die within twelve months, and, therefore, the roots decay quickly, so that, if the land should at any future time be required for agricultural purposes, the process of preparing the soil for the plough could be performed at a much cheaper rate, as timber trees only ringbarked retain

their vigour longer, and toughen the roots. It is the opinion of many that sapped timbers die soon, and the lighter limbs fall off, and thus encumber the ground, whereas those ringbarked take longer to die, and the tree toughens, and what falls off acts as a good manure; but there is no doubt that timber such as budda should not be sapped, as the timber grows thicker than ever. I have seen budda timber that has been felled, and the country is thicker with the trees than it was before an axe was put into it.

Forester Kidston, Condobolin.—In answer to this question, to which I have given much attention, I am certain that the locality in which timber is growing has much to do with the growth of suckers after ringing. Box timber ringed to the "red," or permanent wood, on the level flats near the river (Lachlan) seldom throws suckers; slightly ringed, on the same flats, suckers are certain. The very same kind of box growing on rolling upland country, and rung to the "red" or "sudden death," as it is called, invariably throws suckers abundantly.

Assistant-Forester Postlethwaite, Grenfell.—I think trees should be simply ringbarked—that is, a foot, or at least, 8 inches, of bark should be stripped off. This will prolong the life of the tree to about two years, but in dying gradually the sap dies with it, and fewer suckers are the result, as a certain amount of sap will rise through the alburnum to the upper bark, whereas, if sapped, the sap gets a sudden check, and will sprout with greater vigour. Saplings are more difficult to manage than mature trees; if very small, say up to 3 inches in diameter, they cannot be rung, but are generally cut down, and then suckers spring up without fail. I do not approve of saplings of this size being interfered with, for I know of no remedy against suckers, for, if they are cut off, they will only put out again lower down till they come from the butt; in that case grubbing is the only plan. In ringbarking, every cut of the axe should be downwards, and, while making the lower cut, the handle should be pressed outwards each blow, so as to loosen the bark, and being cut as stated, will form a sort of cavity or cap to hold the water (rain) that runs down the trunk, and thus helps to cause decay. April is the best month for cutting suckers. I cannot give the reason, but this is what I have found to be the case. If suckers are left too long before they are destroyed, and too large to split off the stump, the tree should be ringbarked again below the suckers; this will prevent the ground being covered with dead sticks.

Forester Taylor, Wagga Wagga.—By all means sapped, in either of the two ways, namely, cutting with an up and down stroke, taking the piece clean out to the heart-wood, or else two deep frill rings 4 inches apart. Down-stroke clean to the heart-wood overlapping each cut, so as to leave no sapwood that is not severed, then an outward pressure with the axe handle.

The difference between the two methods speak for themselves. First, the clean up and down cut leaves no lodgment for the rain water, while the frill-cut leaves a cup or basin around the base of the tree which retains all the rain water that runs down the tree, thereby causing the bark in a great measure to rot and peel off, which prevents the growth of suckers considerably.

The taking off a foot of bark, which is termed ringbarking, without it is done just when the sap is in full flow, is next to useless on many kinds of timbers, notably the red gum, yellow box, messmate, &c., and the fine fibres or threads of bark which are left adhering to the tree very soon unite and then form a thin covering of new bark, so that when large blocks of land are to be operated upon it is impossible to ring all the timber during this

time that the sap is flowing freely; further, over every 20 miles of country the season varies, and in some districts where the rainfall is small and uncertain the sap rises with the autumn rains freer than it does with the spring rains.

Murrumbidgee and Murray.

Inspecting Forester Manton, Moama.—The question of ringbarking timber upon Crown lands, I think, should be considered under two heads: First, the destruction of the natural forests by the process of ringbarking with the object of rendering the soil more suitable for pastoral purposes by increasing the production of grass; secondly, ringbarking the useless trees with a view of improving the condition and growth of others.

I am utterly opposed to the system of destroying the natural forests in the extensive manner that it is being carried on in this district, as the extent of untimbered country is very large, and fully as much timber has already been destroyed by ringbarking as I deem advisable on Crown lands, especially when the large alienations of land that have already and are taking place, is taken into consideration, as the alienation of land virtually means the total destruction of the timber. In the course of a short time, on nearly all the alienated land the timber will be destroyed, and the population will be thrown entirely upon Crown lands for their future supply of timber for railways, bridges, fencing, building, and even fuel.

The destruction of the forests of this district has been carried on at an unprecedented rate, and I cannot but think that in the not very distant future, when this district shall become populated, that the wasteful destruction of its timber will be looked upon as a national calamity.

Under the circumstances above stated I would certainly recommend that no future permissions should be given to ringbark timber upon Crown lands in this district. I think that no objection should be raised to the destruction, under proper supervision, of pine scrub, mallee, and other useless scrubs.

With reference to ringbarking the useless trees and thinning the saplings with the object of improving the condition and growth of others, I think that ringbarking with this object could not be judiciously entrusted to the pastoral lessee of the land to carry out.

Forester Condell, Narrandera.—My experience is that simply ringbarking is the most effective, as I find that trees sapped, although killed more suddenly, are much more liable to throw out shoots. Timber ringbarked during the months specified, although it takes longer to die, seldom throws out any shoots.

Forester Wilshire, Deniliquin.—By simply ringbarking you take longer to destroy the tree, but you gradually exhaust the sap, and this prevents a growth of suckers, and it hardens the wood and prevents it falling on the ground for many years. Red gum requires to be well sapped, otherwise the sap runs and forms a new bark. When an old gum-tree is destroyed, hundreds of seedlings at once grow, and it would be an immense advantage if all the old useless gum-trees were destroyed on all the forest reserves in this district, as seedlings would take their place by thousands, and they could then be thinned when at a proper stage of growth.

Forester Guilfoyle, Moama.—I have long been convinced that the safest and best process is ringbarking. The trees may take longer to die, it is true, but then they die to the roots. On the other hand, *re* "sapping," it is, in my opinion, a far more elaborate and tedious process, and, in dealing with a large area, would prove to be most expensive and less effective. I have, in the course of my experience, extending over many years, observed scores of

instances of trees actually recovering themselves after having been "sapped" or "gapped" by the downward cut. Suckers and shoots, too, have been more numerous in the case of box-trees when treated in this way. In the system of ringbarking, should sprouts or shoots or suckers appear, a thing which is sure to occur no matter which system is adopted, they should be knocked or "scalped" off (not cut) when a foot or so in length. To merely cut these shoots is to make them grow the stronger and give endless trouble, because the operation has to be repeated over and over again, like the pruning of a fruit-tree. Of course it may be necessary, in nine cases out of ten, to repeat the so-called "scalping," but then there is the satisfaction of knowing that the death of the tree is a certainty. I do not think it is ever wise to cut far into the sapwood or cambium layer. Either one method or the other should be strictly adhered to. The bark should be stripped to (say) a foot in width.

Forester Payten, Corowa.—To effectually destroy trees the sapwood should be cut through, and all cuts with the axe made downwards.

Also, any other information that may be useful to the Department, especially the effect of ringbarking in the grasses.

The replies to this question are very unanimous, several of them interesting, and will repay thoughtful perusal. There can be no doubt that the effect of depriving the trees of life, whether by ringbarking or sapping, is to increase the quantity and to improve the quality of the grasses, and Mr. Siddins gives a specific instance of improved grass value in the Hunter River district. The improvement is unmistakable, but Mr. Martin points out that (in his opinion, at least) this is not lasting, stating that after about four years it will gradually decrease, but the quantity of grass will always be equal, if not more than equal, to that under live trees.

At the same time, indiscriminate ringbarking is a great mistake. Some shelter is always required for stock, and some thought requires to be exercised as to the best trees and best situations for shade and wind-breaks.

Some foresters go into the effect of ringbarking on the flow of water in natural watercourses, three who refer to this matter specifically stating that it increases the flow of water, while a fourth inclines to an opposite view. There is quite a voluminous literature on this subject already, and we hope to discuss it in the pages of the *Gazette* at some future date.

Forester Pope, Murwillumbah.—The effects of ringbarking are in every case beneficial, both to the land and the grasses, especially to the latter. Grass will, as a rule, begin to grow as soon as the trees die, in places where no grass ever grew before, and the quality is always improved. The grasses are usually coarse and sour when the timber is among them. "Blady" grass, which is of no use whatever, as horses and cattle will not eat it, disappears altogether in two or three years after ringbarking.

Forester Huxham, Grafton.—Ringbarking generally increases the growth and improves the nature of grasses; it also increases the flow of water.

Forester Mecham, Bellingen.—There is no doubt as to the benefit derived, both in increasing the growth and sweetening the grasses.

Forester Macdonald, Kempsey.—Doubtless the grazing capacity of forest land may be materially improved both in quantity and quality of the grasses by ringbarking, but it should be remembered that an injudicious destruction of the forest may also materially injure the drought-resisting capabilities of

the land, as a certain provision for shelter appears necessary for both animal and vegetable life. The best grazing country I have seen, supporting stock in all seasons, is undulating country interspersed with belts and groups of timber.

Forester Brown, Port Macquarie.—Ringbarking or sapping timber appears to have a beneficial effect upon the grasses by improving and sweetening them, also by increasing the quantity. I consider wholesale ringbarking is not advisable, as I cannot think the good effect on the grass will be lasting; but think that killing all useless timber-trees so as to leave from twelve to eighteen trees on an average to each acre for shade and wind-breaks, would have a more lasting benefit on the grasses.

Angus Kennedy, Port Macquarie.—I find that ringbarking doubles the stock-carrying capabilities of land in these rivers where effectually done.

J. M'Lennan, Yarras.—All grasses grow stronger, and the good kinds become sweeter and better, the bad ones becomes more aggressive such as foxtail, sword tussock, and blady grasses on ridges and flats. Gullies wash out badly after ringbarking, and boggy or wet patches appear on the sides of the ridges, but the supply of water is more permanent after ringbarking. On my place I could not notice any difference, on ridges, or flats, or rich, or poor soil, only the white clover spreads with greater freedom now, and the rich ground throws off more wild and useless rubbish, and more good grass.

Forester Rudder, Booral.—The effect of ringbarking or sapping in a general way, especially on undulating and ridgy land, is greatly to improve the pasture, but not in all cases. On rich flats and gullies the timber should not, as a rule, be destroyed, as it induces a very rank growth of coarse tussocky grass of no value; in this way some of the richest of the land is made valueless. The undergrowth, *i.e.*, scrub and smaller trees, should be kept down; but large shady trees—not too thick on the ground—should be left, as they suck up redundant moisture, and help to keep down the coarse worthless grass.

Forester Cobcroft, Singleton.—Ringbarking always improves the land and grass.

Forester Martin, Gosford.—The general effect of ringbarking trees in suitable country, is to improve both the quality and quantity of the various grasses growing under and about them. The death of the tree gets rid of shade, and does not interfere with the action of the sun on the earth, and that which went to make up the life of the tree is retained in the earth, and is given to the various grasses, stimulating them to vigorous and increased growth; but this stimulation is not lasting, and after about four years will gradually decrease, but the quantity of grass will always be equal, if not more, than under live trees. Ample provision should be made for shade and shelter, by leaving belts of live timber. It may be of interest to inquire whether stock diseases have or have not increased since ringbarking.

Forester Stopford, Penrith.—The effect of ringbarking or sapping on the grasses is almost immediately noticeable, and in addition to supplying more nutriment to the grasses, and thereby increasing the growth, has also the effect of sweetening the herbage, and rendering it more palatable and beneficial to stock.

Forester Rotton, Picton.—There is no doubt that ringbarking or sapping has the effect of producing a much larger quantity of grass which is sweeter, and has quite three times the fattening qualities of grass on country not ringbarked, in fact, for either grazing or agricultural purposes, country not ringbarked is useless. It is said that ringbarking decreases the rainfall considerably, but in my district I have not found it so. However I have

frequently seen, in places where ringbarking has been done, springs appear in localities formerly dry, and sluggish springs run freely, giving a good supply of water.

Forester Allan, Milton.—The effect of ringbarking, or sapping, is very marked in the growth of the grasses; it becomes thicker, sweeter, and more fattening for stock. The Braidwood district is an example of what ringbarking and sapping have done for the improvement of grasses.

Forester Harris, Queanbeyan.—The effects of ringbarking on the grasses is very marked ; it produces a more luxuriant growth, and at the same time a far hardier grass, whilst the ordinary kangaroo-grass growing in the district would be killed by the frost. This only applies to ground of good quality, or fairly so, but on strong barren country, ringbarking does not produce such good results, the grass apparently, after a year or two, dying away again. Ringbarking also has the effect of drying up the ground considerably, and I have noticed that where it has been carried out to any great extent, the rainfall is not nearly sc large as in more timbered country.

Forester Crowley, Casino.—Certainly ringbarking improves the country as far as grass is concerned; the grass is much better, and thicker, and has more substance. In flat country in this district, when the soil is much poorer, the carrying capabilities after being rung are three to one, and stock are kept in much better condition. Ringbarking indiscriminately is a great mistake, as stock want shelter in summer as well as winter.

Forester Deverell, Glen Innes.—There is no doubt, in my mind, that ringbarking properly carried out very considerably increases the grazing capabilities of the land; in fact, it not only improves the quality, and increases the quantity, but it makes the hitherto dry gullies run, and often contain permanent water. In ringed timber the grass springs much earlier, but, again, it dies off much quicker in dry weather. In conclusion, I think great care should be taken in reporting and inspecting on application for ringbarking, and I certainly should suggest that owners of conditional purchase leases should not be allowed to ringbark indiscriminately, as I have known cases where the above have been taken up simply to destroy the timber (it being the only timber in that part), so that it could not be used for building purposes, and thus the neighbouring land could not be taken up, as timber was too expensive. Again, it is a shame to see some places entirely denuded of their timbers, utterly regardless of value for shade, shelter, beauty, or market, by indiscriminate ringbarking.

Forester Siddins, Armidale.—The effect upon the grasses is to sweeten and increase them gradually. An entire change of kinds is produced; also artificial grasses are induced to grow without cultivation on the richer soils in this district, immediately after sapping has been done. White clover increases rapidly, and rye also spreads to a considerable extent. The benefit of the improved food to stock is remarkable. As an instance of the increased grazing and fattening results produced by sapping, I may be permitted to mention one case that came under my immediate notice. In the year 1860 the late Hon. James White purchased the Martindale Estate on the Hunter, for the purpose of breeding store cattle to supply his fattening stations, the herd at the time of purchase mustering about 1,800 head, which were feeding over about 40 square miles of country. Shortly after delivery being taken the property was fenced, and the stock confined to a very much smaller area. At this time it was very unusual to find a bullock fit for beef, and almost impossible to get one suitable for market, a few cows (not more than 100) being fit for that purpose in the year. In 1862, Mr. Thomas Hungerford commenced sapping, Mr. White following his example, which was

continued until the whole of the property was operated upon. The improvement in the grass was noticeable within six months of the operation being done, and continued up to the time of my leaving in 1876, the carrying capacity being then increased to over 3,000 head, and the average number of fat bullocks sold annually was 1,000, the quality of the cattle being superior to the bulk of stock landed in Sydney from Liverpool Plains or elsewhere.

Forester Kingsford, Gunnedah.—Beyond a doubt, ringbarking is the means of causing the better class of grasses to grow where formerly nothing but the coarse native grasses were found, besides sweetening the ground generally, but where carried on to too great an extent the grass is more liable to become injured in the event of frost.

Forester Marriott, Mudgee.—The grass of good country, with deep soil, is always improved by ringbarking, but on poor and shallow soils, grasses sheltered by the timber, stands longer, being liable to dry up quickly when exposed. On plains, likely to suffer from drought, timber should be preserved or only a judicious thinning out allowed.

Forester M'Gee, Narrabri.—The effect of ringbarking or sapping is most beneficial upon grasses of all kinds, causing a more abundant crop and a greater variety, the quality being superior in every way. I am not in favour of wholesale and indiscriminate ringbarking. Ringbarking or sapping in heavily timbered country causes the land to be moist, and retains moisture longer, and in some cases it produces surface springs of water, which are more or less permanent.

Forester King, Coonamble.—There is complete proof that the ringbarking of average timber considerably improves the grazing capabilities of the land, always taking into consideration that certain trees should be left for shade, shelter, &c.

Forester Kidston, Condobolin.—The effect of ringbarking on the grasses is immediate and unmistakable, the thicker the timber killed the greater the benefit, up to quadrupling or more the grazing capability.

Assistant Forester Postlethwaite, Grenfell.—Ringbarking will enhance the growth of all grasses, and I do not see much difference in the growth whether the timber is sapped or merely ringbarked. It also makes the herbage sweeter, and stock prefer it to grass grown in green timber; this I have proved, for I have seen a paddock, half only of which was ringbarked, and the sheep kept in the rung timber till the grass was quite exhausted before going into the green timber.

Forester Taylor, Wagga Wagga.—The effect of ringbarking upon the grasses is first to cause the wiry sapless grasses to die out, then the classes of new grasses are sweeter, quicker grown, denser, and more nutritious and lasting, caused by the effect of the sun and light drawing the moisture nearer the surface. It must be borne in mind that the aspect, altitude, and variations of climate all cause apparent effects upon ringbarked timber; also the westerly winds during the summer months.

Inspecting Forester Manton, Moama.—There is no doubt that ringbarking has a great effect in the more abundant production of grass.

Forester Condell, Narrandera.—The ringbarking of timber I find, from my experience, has a very great effect for good as regards the growing of the grass, as ringbarked country grows splendid crops of grass, whereas you will find the country in its natural state as regards timber alongside the ringbarked country without a vestige of grass on it.

Forester Wilshire, Deniliquin.—By ringbarking the grass does not come nearly so soon as by sapping. Most of the box timber in this district has

been sapped, and the pastoralists and selectors have now great difficulty in getting rid of the suckers and also the box seedlings in moist ground.

Forester Guilfoyle, Moama.—As regards ringbarking on the grasses, it is a fact that in some of the thickly timbered country of this district, after a successful ringbarking, and the trees have withered for (say) eighteen months or so, is a pleasure to look at places where a blade of grass could scarcely be visible heretofore, now clothed with a dense carpet of green. The grasses spring up like magic; in fact, as if sown by hand.

Forester Payten, Corowa.—Ringbarking has a wonderful effect upon grasses and herbage. I have noticed land prior to the trees having been ringed thereon that the roots of grass and herbage were very scant, but in about two years after the trees were destroyed the grass and herbage could have been mown.

Bibliography of Ringbarking.

Much valuable information on the above subject is contained in proceedings of societies, official reports, and in miscellaneous works. The botanist proposes to publish a brief bibliography of ringbarking in the pages of the *Gazette*, and readers are asked to kindly favour the Department with references to any publications on the subject.

Poultry.

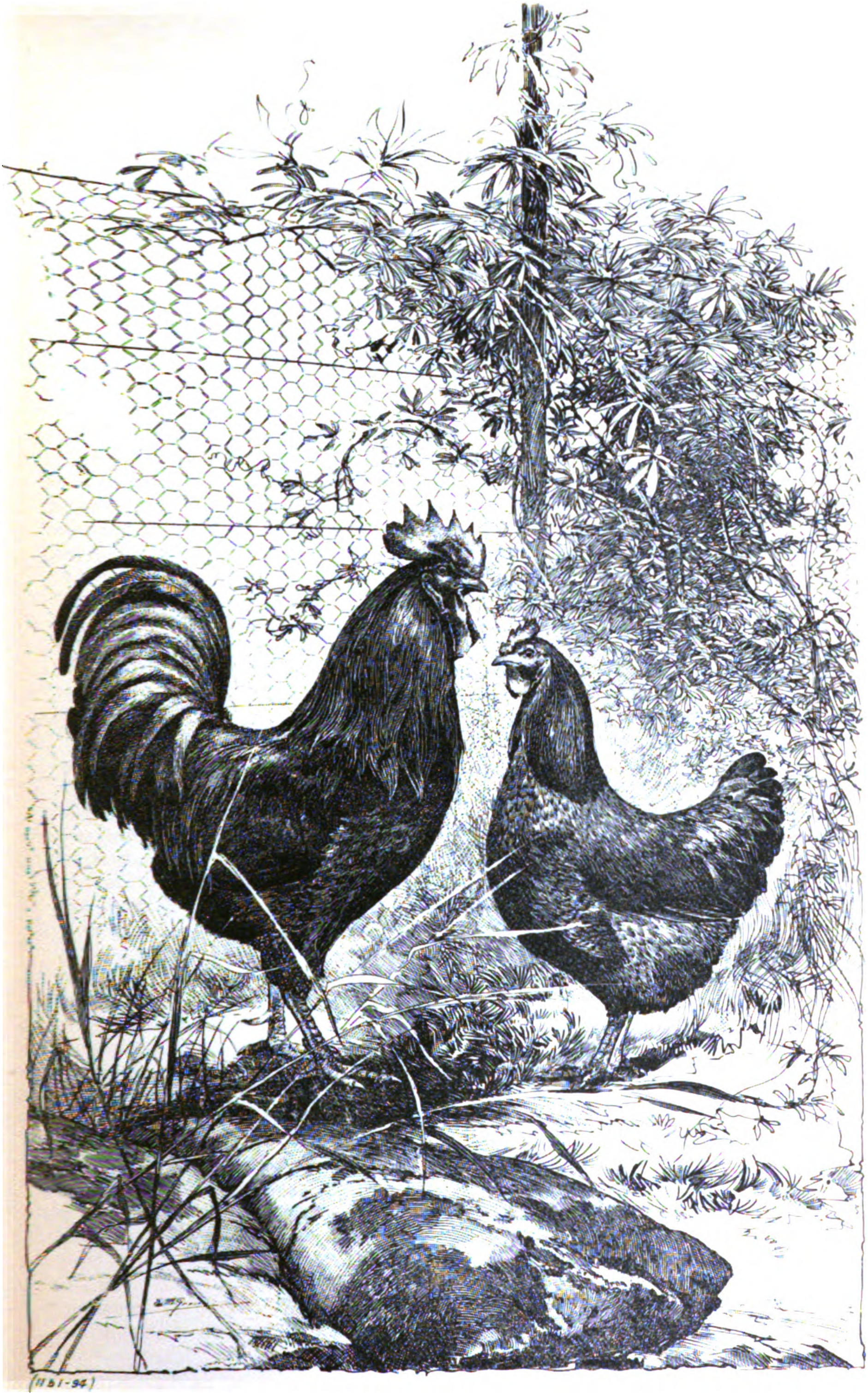
BY S. GRAY,
Sub-Editor.

THE ORPINGTON.

THE breed with which I propose to deal in the present article occupies in England a similarly unique position to the Australian game on this side of the equator, as being the only breed actually and successfully produced there. This is peculiarly remarkable from the fact that English fanciers have, almost without exception, been able to considerably improve any breed of fowl which has passed through their hands, even those originating in America, the home of the majority of new breeds. Without going into foreign matter, this fact appears to be very characteristic of the two peoples, and what, upon consideration, might have been expected from the "push" of Americans, as opposed to the deliberate and conservative nature of English people and—may I be permitted to add—of New South Welshmen.

It is also interesting to note that the objects which the originator had in view—hardiness and economic value—have undoubtedly been achieved. The originator, Mr. Cook, of Orpington House, St. Mary Cray, Kent, first crossed large Minorca cocks with black "sport" hens of the Plymouth Rock, and then bred selected pullets resulting from this cross with clean-legged Langshan cocks, fixing finally the desired characteristics by selection and the provision of unrelated strains. The result of these operations may be seen in the accompanying illustration, which was drawn specially for this article by Mr. E. M. Grosse, from two birds in the possession of Mr. J. E. Pemell, of Randwick, both of which have obtained "firsts" in Sydney and Melbourne.

The slight economic value attaching to the usual run of feather-legged birds first called my attention to the Orpington, as one which, while possessing all the handsome appearance of the Langshan, appeared to me more like the business bird. I, therefore, obtained a setting of eggs, which all hatched out, and I saved eleven hardy chicks in a very trying season. The youngsters were not the slightest trouble; they grew rapidly and feathered quickly. I thought at first that the amount of white they showed portended something wrong, but find that this is characteristic of the breed. I felt fairly satisfied as to their hardiness, but shortly afterwards had ample proof of it. I had occasion to change my place of residence, and owing to a variety of circumstances was unable to provide comfortable quarters for my birds during the whole of last winter. The Orpingtons went through rain, frost, and general discomfort without a sign of ill-health; in fact, they appeared rather to like it, and the pullets started to lay early in August. As they were not hatched out until the middle of the previous December, they were laying at 8½ months old, and when frosts where I reside are nothing like over.



ORPINGTONS.

Bearing these facts in mind, I determined to take an opportunity of getting Mr. Pemell's opinion regarding them, and while the picture was being drawn I had several opportunities of doing so. As is known, Mr. Pemell is an experienced breeder of many varieties, and speaking of the Orpington he considers it to be the best all round fowl he has ever kept. He holds a decidedly adverse opinion to the introduction of the rose comb, on the ground that this introduces a difficulty in breeding, which is outside the original intention. Mr. Cook admits that his object was to produce a self-coloured bird, with no point requiring any particular care in breeding, useful both as a layer and a table bird. These qualifications, Mr. Pemell contends, exist to the full in the single-combed bird, and therefore the rosecomb is an unnecessary and detrimental innovation. In this opinion I cordially agree with him. Unless a rosecomb is almost perfect it is anything but pretty, while the neat single comb appears to me to be exactly suited to the general style of the bird. It is often remarked by the Langshan breeder that the Orpington is only a clean-legged Langshan, to which I reply that to that extent it is an improvement, as there is to me no particular beauty in a few straggling and usually dirty feathers on a bird's legs or feet.

The particular claims of the Orpington are that it combines the good-laying qualities of the Minorca—the eggs, however, being brown-tinted—with the weight of flesh common to the Plymouth Rock, added to which the whole black feathering makes it an easy bird to breed. They have a white skin and flesh, the latter being very fine, and tasting much the same as that of the Dorking; feather and grow faster during the first six weeks, and are easier to breed true to colour than the Plymouth Rock; lay rather more eggs; are not so liable to become fat internally; and are not such persistent sitters as Rocks. My experience of them in this country leads me to admit all these claims, with the reservation that I have not found the Plymouth Rock a "persistent" sitter. I must not omit to add that the Orpington appears equally contented and healthy whether in freedom or confinement, in town or country. I have not sufficient personal experience to compare it with the Langshan as a winter layer, but am informed that it runs its feather-legged rival pretty closely in this respect, and there is little or nothing to choose between them on the table. Under all the circumstances, I feel perfectly safe in recommending the Orpington as a very desirable fowl to keep.

To enable would-be purchasers to select the right thing, I give Mr. Cook's description :—"The plumage should be very glossy in both sexes, but more particularly in the cock. The sheen should be much the same colour as a good Langshan; single combs, evenly serrated in both sexes, standing erect in the cock, not large, but neat; red face and ear-lobes; black or dark legs, not too long; white toe-nails, four toes on each foot, well spread out from each other. The hen's comb may fall a little to one side if it is evenly serrated, and without folds in it." The cocks weigh from 9 to 12 lb., and the hens 6 to 8 lb.

In addition to Mr. Pemell, I find the following breeders of Orpingtons in New South Wales:—Mrs. R. Graham, Five Dock; Mrs. W. H. Webb, Bathurst; Mr. P. S. Grunsell, Goulburn; Mr. T. Hall, Fairfield; Mr. C. Penrose, North Willoughby; Mr. L. L. Ramsay, Five Dock.

Practical Vegetable Growing.

Directions for the Month of February.

The month of February is generally exceedingly hot all over the Colony, and unless good showers of rain occur the growing of vegetables is a somewhat difficult matter where good supplies of water cannot easily be obtained. However, frequent cultivation in stirring the surface soil will work wonders. At first sight it seems perfectly absurd to keep hoeing away on soil that is almost dust, in the hope of preventing evaporation, but anyone who will really think and reflect, and make experiments, will find the frequent, almost daily, stirring up the surface soil will have the same effect as a mulch. It should not be difficult on any farm to collect an excellent supply of the droppings of cows and horses, which can be used as a thick mulch. If the cow-dung be spread in big lumps some of it will become as hard almost as stone. This is not desirable, for, although it will act admirably as a mulch, it would not be advisable to dig it into the ground after it has served its purpose as a mulch. If water is abundant a good supply of vegetables can be raised. It is not the best practice to over-water, for then the vegetables are not as good as if the water were supplied judiciously, chiefly in the shape of liquid manure. In places where water is scarce it would be desirable to save all water that has been used for household purposes. This is excellent for the garden, and even where water is abundant it should be preserved. The loss annually from the waste in an ordinary household is surprising when its value as manure is considered. This is one of those little matters that deserves thought, but which is only too often overlooked. In the rainy, moist parts of the Colony the difficulty of preventing the growth of weeds is considerable, and sometimes almost impossible. One of the worst of the weeds is the common summer grass, *Panicum sanguinale*, which grows with wonderful rapidity, and soon overtops all vegetables if not prevented. The hoes must be kept exceedingly sharp, but great care must be taken with their use, as a mere touch may destroy a vegetable.

As seeds of many different kinds of vegetables should be sown this month, in order to raise plants for transplanting later on, a good deal of trouble should be taken to make suitable seed-beds or to prepare boxes or pots in which to raise them. As pointed out some months ago, a small portion of the garden should be set apart for raising seeds. This could be made a most useful, interesting, and instructive place, where various little experiments could be carried out, where cuttings could be struck, seedling fruits raised, and so on. The time necessary to spend here need not be great, but it would serve to break the dull monotony of the usual farm life, and improve the mind by providing food for thought.

French Beans.—These may be sown during the month as largely as may be considered necessary. The reader's attention is directed to an article in this *Gazette* by Mr. Valder, showing the results of some careful experiments made

with beans. It will be seen that the variety named Canadian Wonder is the most profitable one to grow. It can be highly recommended. A variety named Sutton's Selected Canadian Wonder, raised in England, is said to be an improvement on the Canadian Wonder. "The pods are of immense length, very handsome, and are fit for use several days earlier than that good old variety, although sown at the same time." It is not known whether this variety has yet been tested in the Colony.

Beet, Red.—Sow a little seed in rows. Probably one row will be sufficient at a time. Select rich ground, such as had been heavily manured for some previous crop. Before sowing the seed make a shallow drill—say about an inch or so deep. If the soil has been made quite fine a drill can be made with the forefinger. Drop the seed in the bottom of the drill, and if the soil is dry, water well before covering up, so as to give the seed a thorough soaking, and then cover over with fine soil, and press it down with the back of the spade. Always use a line to mark out the rows. A thick piece of string will serve the purpose well, and will last for a long time if taken care of. Plants that are growing should be thinned to about 9 inches or even to 12 inches apart in the rows. If the young beets that are thinned out are lifted with a little care they may be planted out if required.

Beet, Silver or Spinach, is an excellent vegetable to grow. Sow a little seed in rows, and afterwards thin out the seedlings when they have attained a height of about 2 or 3 inches. It may, perhaps, be more convenient to sow in a seed-bed and afterwards transplant in much the same manner as is adopted for cabbages, &c. The soil for this plant should be heavily manured with well-rotted, rich manure, for the leaves, and not the root, is the part used as a vegetable. The rows in the permanent bed should be about 2 feet apart, and the plants should stand about 2 feet, or so, distant from one another.

Borecole or Kale is best suited for the cool parts of the Colony. It belongs to the Brassica or cabbage family. The seed should be sown in seed beds or boxes, and the seedlings afterwards transplanted. The soil should be made rich with well-rotted stable manure. Plant in rows 2 feet apart each way.

Broccoli resembles the cauliflower, and might easily be mistaken for it; in point of fact, it is a variety which takes longer to arrive at maturity, and there are other differences which are very apparent to one used to growing vegetables. Seed to a small extent may be sown in a box or seed-bed.

Brussels Sprouts.—This is another and excellent variety of the cabbage, but differs in a most marked degree from that vegetable. The stem grows to a considerable height, and bears numbers of miniature cabbages. It is very suitable for cool districts, and should be grown wherever it will thrive, for it is one of the best of vegetables, and can be grown as easily as an ordinary cabbage. Seed should be sown in a box or seed bed, and every care should be taken in watering and shading sufficiently. When the plants are large enough they should be moved to well dug up but not too heavily manured ground that has been prepared for them. The growth should not be too rank, and the plants must not be forced or else the young sprouts will not form well. If the ground is naturally rich it may, perhaps, be as well not to apply manure. However, if they do not thrive, manure can easily be applied in a liquid form. Plant in rows about 2 feet 6 inches apart. The plants to stand about 2 feet from each other in the rows.

Cabbage.—Sow seed in as great a quantity as may be needed, in a seed-bed. Sow thinly in little rows, about 2 inches apart. A few plants may be set out in well manured ground, from time to time, in order to keep up a succession.

Carrot.—Prepare some ground by digging deep and fine, and by well draining, but avoid applying manure unless absolutely necessary, and then take care that it is old and thoroughly rotten. The best way to manage is to use a bed, or part of a bed, which had been heavily manured for some other vegetable. If fresh manure is used the roots will, in all probability, become forked, and of bad shape. Sow the seed in drills, which should be made not deeper than half an inch. Cover over with fine soil, and firm down with the back of a spade. The seed is covered with little hooks, and care should be taken that it be well separated before sowing. The drills should be from 1 foot to 18 inches apart. The seed will take a good while to come up, and as the plants are exceedingly small at first the weeds should be looked to as often as possible.

Cauliflower.—Seed of this favourite vegetable may be sown largely during the month in a seed-bed, box, or pot, in the same way that cabbage and all others of the same family are sown. The seedlings, when large enough to move, will be improved by being planted out or "pricked out," in a small bed, about 4 inches apart, where they can develop into good, strong, young plants for transplanting. The distance apart the plants should stand will depend on the richness of the soil. The better the soil the wider apart the cauliflowers should be planted. The distance may vary from about 2 feet or 2 feet 6 inches to 3 feet. At the same time it should be kept in mind that although the soil may be poor, and but little manure has been dug into it, the plants can be fed by liquid manure, and made to grow to a very large size. In a few words, the distance at which plants should stand from one another will depend, in a great measure, on the quantity and quality of plant-food available.

Celery.—Sow a pinch of seed in a box or pot. When the plants come up, and are large enough to shift, prick them out in a small bed, where they can grow strong and hardy.

Endive is a good substitute for lettuce. A little seed may be sown during the month.

Turnip, White.—Seed may be sown in drills, in well-manured ground. When the plants come up, thin out well.

Turnip, Swede.—Sow as largely as necessary, as above.

Potato.—An effort should be made to raise a good supply of this useful vegetable. The soil should be well drained, well worked, and heavily manured with the droppings of farm animals. For seed, medium-sized whole potatoes are to be preferred to large ones cut into sets. The rows had better be wide apart, say 3 feet, and the sets put in about 1 foot apart in the rows. Plant about 5 or 6 inches deep. If it is necessary to use cut sets take care that the cut sides are dry before planting.

Peas.—If the weather is moist a few rows may be sown in the cool districts. The dwarf varieties are to be preferred for this season of the year.

Radish.—Sow a few rows occasionally during the month. Use well-rotted manure, and water occasionally if the weather is very dry.

Orchard Notes for February.

All over the Colony February is a fairly busy month for the fruit-grower, for, though a large portion of the peaches, plums, and pears, early apples, and all the cherries and apricots have been disposed of, there is still a large amount of fruit to market, so that the principal work during the month, as during January, will be the gathering and disposing of the fruit. The remarks that have previously appeared in these notes about the care to be taken in the grading, packing, and handling of the fruit should be borne in mind. It is impossible to impress upon the fruit-grower too often or too strongly the necessity for carefully attending to this most important matter. It is an undoubted fact that the better the appearance of the fruit when placed on the market, the better it will sell.

The cultivation of the orchard should be carefully attended to during the month, as if neglected the late fruits are likely to suffer. This is especially the case in the drier districts of the Colony where, as has been previously stated, the secret of success in fruit-growing is keeping the ground in a thorough state of cultivation. During the month the banding of the trees for codlin moth should be carefully attended to, and the bandages should be removed, and the worms destroyed every ten days, or at the outside every two weeks. If grasshoppers or crickets are destructive, they must be fought by poisoning the food on which they are feeding. The best remedy to use in this case is Paris green, 1 lb. to from 160 to 200 gallons of water, according to the nature of the plant to which it is to be applied. The softer and more easily injured the plant the weaker the mixture.

Drying should be continued during the month, either by the use of an evaporator, or by means of the sun in the drier districts, but even in the latter, it will be necessary to provide arrangements for covering the fruit in case of rain, so that an evaporator is usually preferable. By means of drying or evaporating, much fruit that is at present wasted might be utilised and converted into a marketable commodity. The requirements in fruit for drying are a firm solid flesh, and a juice rich in sugar, to produce the best results.

Budding over unsuitable varieties of fruit may be continued during the earlier part of the month, especially in the later districts, and the buds that were put in during January should be attended to, and the ties cut where necessary. It is not a good plan to start the buds the same season that the trees are budded, and for that reason it is not advisable to bud too early. The requirements necessary for successful budding are, first, that the stock is in good working order—that is to say, the sap must be running, and the bark lift easily; secondly, that the buds are strong, plump, and well developed, and are taken from none but healthy vigorous trees. In tying the bud always take care to tie very tightly up to the shoulder of the bud, as that is where the union must take place. Nursery work will consist in keeping the rows clean and well worked, and in attending to the budding, removing the ties, &c.

General Notes.

The Export of Wines.

The difficulties connected with the placing and disposal of pure and sound Australian wine on the London market bid fair to be finally and satisfactorily overcome. A letter has been received by the Department of Agriculture from Mr. C. A. W. Lett, Curator of the New South Wales section of the Imperial Institute, in which that gentleman points out that at present, owing to the unsatisfactory manner in which the Australian wine trade has been manipulated, English consumers have become prejudiced. The chief cause of this is the difficulty of obtaining regular supplies of wines of even quality—the many cheap concoctions of Italian and Spanish wines that are sold under the denomination of Australian wine have also seriously affected their reputation.

It appears that constant inquiries are being made at the Institute as to where really good light Australian wine can be procured, and as a first step towards meeting the evidently growing demand, Mr. Lett offers to make arrangements to have any sample shipments forwarded to him sold in the dining-rooms and bars of that Institution and other places of popular resort. For this purpose he suggests that the most suitable wines to send are those of fair age and maturity, which could be retailed at about 25s. per dozen for family use. He will also be willing to arrange to dispose of bulk wine of similar quality, in octaves and quarters, samples of which could be sold at the Institute and other places of public resort at 4d. per large glass. Mr. Lett mentions that at the present time there is not a single place in England where Australian wine of a reliable quality can be obtained by the glass, and that such an innovation will be very popular and do much to increase the demand for our wines, and to break down the prejudices which at present exist against it; for it is only by, in the first instance, having them sold in this manner that they can be really popularised, and the public taste gauged. There is also a demand for the more expensive wines, the disposal of which Mr. Lett will also be glad to supervise, which would compete with Beaune and Burgundy sold ordinarily at 36s. to 50s. per dozen, and it is not considered that the sale in the manner proposed of the cheaper wines would adversely affect this class of trade.

Fully recognising the absolute necessity of exercising a wise discretion in regard to the wines to be shipped, the Department has been successful in obtaining the consent of Mr. P. F. Adams and Dr. Fiaschi to form, in conjunction with Mr. J. A. Despeissis, Consulting Viticulturist to the Department, a committee to test any wines that may be submitted before such wines are shipped to London, the Department taking no responsibility beyond the testing and ascertaining that the wine sent in bulk for shipment corresponds to the sample, and is of the required quality.

These gentlemen have already held a preliminiary meeting, at which a scheme was drawn up which it is hoped will be practical and effective, and the Department hopes to be in a position to announce shortly to wine-growers what steps it will be necessary for them to take in order to be benefited by the services of this committee. In spite of any energy which may be displayed it will of course be seen that complete arrangements, including the dealing with shipments in London, will necessarily occupy considerable time, but by means of this early intimation it is thought that intending shippers may be able to consider the matter, and make necessary preparations for taking advantage of so promising an opportunity of extending their business.

So soon as the brands and types of wines best suited for export become well established, Government advice will be suspended, and the trade left to progress on its own merits. Full particulars as to the cost of freight, &c., may be obtained from the Department of Agriculture.

Planter's Friend.

The following notes as to the production and composition of the variety of sorghum known as Planter's Friend may be of interest to sorghum growers:—

Mr. W. Graham, of Minnamurra Farm, Jamberoo, communicates the following results of his sowing:—

The seed was sown late in December, 1892, at the rate of a little over 16 lb. per acre. The crop cut from 6¾ acres during the months of May and June of this year, amounted to 247 tons 14 cwt. of fodder, being an average of 36 tons 14 cwt. per acre.

Cost of Production.

	£	s.	d.
Ploughing, harrowing, sowing, and seed, at £3 per acre	20	5	0
Rent	5	0	0
	£25	5	0

Average cost of production 2s. per ton.

The paddock where this crop was grown is situated on the northern side of the Minnamurra River, having a south-westerly aspect. The soil is fairly rich, being of volcanic origin. It has been grazed for years without manure, and it is stated that it has been cropped with wheat upwards of forty years ago. The fodder has the following composition as determined by the chemist:—

Water	73·82	per cent.
Ash	·95	„
Albuminoids	2·28	„
Ether extract	·55	„
Crude fibre	6·06	„
Carbo-hydrates (nitrogen free extract)	16·84	„
	100·00	„
It contains sugar	5·76	„
Nutritive value	20½	„
Nutritive ratio	1–8	„

It will be seen from this that the feeding value is fairly high, and the proportion of albuminoids especially high.

It would be of interest to determine its value in the production of milk. It will probably be found most valuable as a mixed food with bran.

Rust-resisting Wheats.

In the July issue of last year we published a list of wheats which had been distributed to farmers, with a view to testing their rust-resisting qualities in different parts of the Colony. It was known at the time that under certain conditions some of those wheats were liable to rust, but owing to their possessing such good qualities as earliness in maturing and prolificacy, it was decided to include them in the distribution. The results of still further experiments which are being carried out by Mr. Wm. Farrer at Lambrigg, Queanbeyan, enable us to somewhat qualify the former list, and the following may be taken as varieties which are now known to possess rust-resisting qualities, at any rate so far as that district is concerned:—

Amethyst,	Niagara,
Algerian,	Pringle's Defiance,
Bega,	Saxon Fife,
Belatourka,	Smith's Nonpareil,
Blount's Lambrigg,	Square-headed Sicilian,
Blount's Fife,	Summer Club,
Egyptian Mummy,	? Talavera,
Fluor-spar,	Thomas' R. R.,
Fultz,	Tourmaline,
Hornblende,	? Victorian Defiance,
Improved Fife,	Ward's Prolific and Ward's White,
Manitoba,	White Fife,
Medeah,	58 A (Jock).

A New Calf-feeder.

According to the *Melbourne Leader*, the firm of Messrs. Clarke & Co., of Elsternwick, Victoria, have succeeded in devising a very useful and, at the same time, inexpensive calf-feeder. The feeder consists of a tube about 15 inches long, at one end of which is fixed a strainer, while to the other end, which is bent, is attached an indiarubber teat. In using the feeder it is only necessary to place the bucket of milk on one side of a fence, and drop the strainer-fitted end into the milk, while the teat end is passed through a hole in a fence, and given to the calf, which may then be left to suck away at pleasure. There is a shield fixed to prevent the calf pulling the tube through a fence, and of course there is no possibility of the bucket being upset. Under this arrangement the calf feeds in a natural manner, inasmuch as the use of the teat excites salivation, whereas in drinking from a bucket, in the usual way, the calf gulps down a quantity of milk which it cannot readily digest. It is reported that several well known farmers have adopted the feeder after satisfying themselves of its utility.

LIST OF AGRICULTURAL SOCIETIES' SHOWS, 1894.

Society.	Secretary.	Date of Show.
		1894.
Wollongong A. Society	... J. A. Beatson ...	Jan. 31, Feb. 1
Manning River (Taree) A. and H. Association ...	... W. Plummer ...	Feb. 14, 15
Tumut A. and P. Association	... W. H. Bridle ...	Feb. 27, 28
Marulan P. A. H. and I. Society	... H. Morice ...	Feb. 23
Candelo A. Association	... C. H. Brooks ...	Feb. 27, 28
Tenterfield P. and A. Society	... J. Harker ...	Feb. 27, 28, March 1
Port Macquarie A. Society...	... A. E. Pountney	Feb. 28, Mar. 1
Lismore A. Society	... C. S. Connor ...	Feb. 28, March 1, 2
Royal Agricultural Society of New South Wales	... F. Webster ...	Mar. 21 to 27
Castle Hill A. and H. Association	... F. H. G. Rogers...	Mar. 26, 27.
Upper Manning A. and H. Society (Wingham)...	... P. Doust ...	May 16, 17, 18.

N.B.—Secretaries will greatly oblige by giving the Department early intimation of the dates fixed for Shows.

[4 plates.]

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Eucalyptus rostrata, Schlecht.

"Murray Red Gum."

Vol. V, Part 2. *FEBRUARY.*

Useful Australian Plants.

By J. H. MAIDEN,
Consulting Botanist.

No. 6.—The Murray Red Gum (*Eucalyptus rostrata*, Schlecht).

Other Vernacular Names.—The "Flooded Gum" of the interior of Western and South Australia. In western New South Wales it is called "Creek Gum," as it is always found near watercourses. There are several trees which grow under the name of "Red Gum" in these colonies. One of them is the smooth-barked Apple (*Angophora lanceola*), which in New South Wales is often called red gum, but most of the trees known by that name are Eucalypts. The red gum of Western Australia is *Eucalyptus calophylla*, while in the neighbourhood of St. Vincent's Gulf, South Australia, *Eucalyptus odorata* goes by that name. In our own colony two other valuable timbers also go under the name of red gum, viz., *Eucalyptus tereticornis*, a tree bearing close affinity to *rostrata*, but it is essentially a *forest* timber, in contradistinction to *rostrata*, which is a *river* timber. Then the leather-jacket or grey gum (*E. punctata*), is also known as red gum occasionally; but *the* red gum *par excellence* of these colonies is *Eucalyptus rostrata*, and by way of distinction I have denoted it, on account of its most celebrated locality—Murray Red Gum. It is the tree which produces directly to the Colony by far the most revenue of all our trees, and it is so important and so interesting to us in various ways that I propose to deal with it in detail.

Aboriginal Names.—By the aboriginals of the Lower Murrumbidgee it used to go by the name of "Biall," while to those of the western interior it was known as "Yarrah," a name which it shared with some other trees.

Botanical Name.—*Eucalyptus*, from two Greek words, eu-kalyptos, signifying "well-covered," and alluding to the little cap (usually more or less conical or dome-shaped) called the operculum, which covers up the unexpanded flower, and which is thrown off as the flower opens. *Rostrata* is a Latin word, signifying beaked or snouted, and this specific name was given to the red gum, because of the beaked appearance of the flower-bud.

Flowers.—This is a good honey-yielding tree. Mr. E. A. Coleman, a bee-keeper, of South Australia, pronounced it, when speaking of the trees of that colony, to be "about the best."

Leaves.—The leaves of the red gum emit a pleasant odour when crushed in the hand, but the eucalyptus oil they contain is not a regular article of commerce, as it is not yielded in payable quantity. Mr. Bosisto thus reports on it in the *Trans. Roy. Soc. of Victoria*, vol. vi, 1861-4:—"Plants grown on high ground give an oil of a dark-amber colour, possessing an

agreeable aromatic flavour, and having the odour of caraways. The yield from 100 lb. of the fresh-gathered leaves was 1 oz. 6 dr. The plants grown on low marshy soil yielded an oil of a pale-yellow colour, in appearance and smell similar to that yielded by *E. odorata*, the quantity being $9\frac{1}{3}$ dr. to 100 lb." Last year, M. Mellon, of the Dunolly Scent Farm, Victoria, obtained no less than 7 oz. of oil per 100 lb. of leaves.

In Mueller's edition of Wittstein's work we find the following:—"The essential oil is pale-yellow to reddish amber in colour; it smells and tastes like that of *E. odorata*. Its specific gravity is 0·918, and it boils at 137° to 181° F."

The celebrated essential oil firm of Schimmel & Co., of Leipzig, Germany, have also examined this oil (*vide* their ***Bericht*** for October, 1891). Their oil was prepared by M. E. Mojon, of Algiers, from trees grown in that country. They determined the specific gravity of their sample to be 0·924 at 15° C., and the optical activity + 12° 58' in a 100 mm. tube. The oil has a powerful odour of valerianic aldehyde, and is rich in lineol. *E. rostrata* and *E. globulus* appear to be the only two eucalyptus oils known to contain valerianic aldehyde up to the present.

Quite recently, Mr. W. Percy Wilkinson, of Melbourne, has made a valuable preliminary investigation of the eucalyptus oils of Victoria (*Proc. Roy. Soc., Victoria*, 1893, p. 195). Amongst others, he has examined three specimens of red-gum oil, and following are his results:—

Sample.	Specific gravity.	Specific rotation.	Refractive index.	Specific refractive energy.
1	·9120	+ 8·7°	1·4604	·5072
2	·9216	+ 2·2°	1·4600	·5014
3	·9222	+ 0·5°	1·4607	·5018

None of them gave the Phellandrene reaction.

Exudation.—The kino of the red gum is perhaps the best known of all eucalyptus kinos, chiefly through the enterprise of Mr. Joseph Bosisto, of Melbourne. In the Deniliquin district at least, fishermen and others chop a few chips in the bark of the red gum and extract the liquid kino from the trees. This kino is sent to Melbourne in jars, and it yields about 8d. per lb. in the Melbourne market. As this substance is a Colonial vegetable product in regular demand, it will be useful to some people to have the following notes of it which were published by me in the *Proceedings of the Linnean Society of New South Wales* for September, 1891:—

It is a useful astringent, and it seems to be increasing in favour with medical men in England, America, and Australia.

The official kino (*Pterocarpus*) contains, I believe, no substance which is not contained in this and some allied kinos, for which they appear to be a perfect substitute. See *Pharm. Journ.* [3] xx, 221, 321.

The kino of *E. rostrata* will be found mentioned in all modern works on Materia Medica. In Martindale and Westcott's *Extra Pharmacopœia*, for instance, we have the following:—

"*E. rostrata* and *E. corymbosa*, and probably other species imported from Australia. It is semi-translucent and garnet-coloured, not so dark as but resembling kino in appearance, soluble in water, tough, difficult to powder [not correct as applied to these two kinos.—J.H.M.], it adheres to the teeth when chewed, is intensely astringent to the mucous membrane, useful in diarrhœa, relaxed throats, and given with success to check the purging of mercurial pills."

But the following statements pertaining to the percentage of tannic acid and the solubility are somewhat misleading, since I have shown the enormous variation in the properties of kinos caused by age :—

"Of 100 parts, 90 are dissolved in cold water, the solution being clear; 27 parts of isinglass precipitate all the astringent matter.—Squire's *Companion to the B. P.*

Dr. Wiesner says of a sample :—

"Easily soluble in water and alcohol; solution neutral, free from gum-resin. Broken masses of zircon-red, sometimes light brown, mixed with bits of bark."

Following are experiments on "Red Gum" kino purchased in Sydney, 22nd November, 1888, of Victorian origin :—In lumps up to the size of peas, though angular. Prevailing colour, purplish-brown; is readily powdered between the fingers, forming an ochrey-brown powder. The mass of kino has not the brilliant appearance of the kinos of the ruby group, owing to this friability.

In cold water it dissolves fairly readily, and almost entirely to a reddish-brown liquid.

Its composition (determined November, 1888) is :—

Catechin and tannic acid	84·3
Ligneous matter, &c.	·3
Moisture	15·2
Ash	·2
	100·00

Tannic acid determination (Löwenthal), 46·22 per cent.

A specimen of kino from the "Creek Gum," Tarella, Wilcannia, 23rd August, 1887 (diameter, 1–2 feet; height, 30–40 feet), gave the following results :—It is only obtainable in rather small quantities, and in rather small pieces; pale, as kinos go, very bright-looking, and of a ruby colour; powders fairly readily, forming a powder of a light-brown tint. It dissolves almost immediately to a pale brownish or almost orange solution, leaving a sediment of a whitish-salmon colour with a few dark-coloured particles, like those of *E. goniocalyx*, only cleaner-looking.

Its composition, determined October, 1888, is :—

Catechin and tannic acid	82·7
Ligneous matter, &c.	·6
Moisture	15·8
Ash	·9
	100·00

Tannic acid determination (Löwenthal), 47·746 per cent.

Bark.—The bark of the red gum is white and smooth, with some of the outer bark falling off in thin patches. In the classification of eucalyptus trees according to their barks it falls under the head of "Leiophloiæ," or "smooth-barks."

Timber.—I do not suppose that there is a person resident in Victoria or South Australia for six months who does not well know what red gum is, but comparatively few people in New South Wales know the timber. The reasons for this appear to be two. The first is that our magnificent red-gum forests are practically at one extremity of our extensive colony, whereas in the other colonies red gum is extensively (though sparsely) distributed; and secondly, comparatively little red-gum timber is used in New South Wales for public works. The reason is, that we have had ironbark and other valuable timbers more readily available; but as ironbark becomes scarce I see in red gum a substitute efficient in various ways.

It is of a rich red colour, darkening much with age, close-grained and durable, almost as hard as iron when thoroughly dry, of inlocked fibre, difficult to split, but when sawn will rend and twist if exposed to great summer heat. Its hardness limits its use for furniture, though it is often used for that purpose in the southern colony. On account of its durability it is largely used for house-blocks, and also for paving-blocks, street-kerbing, slabs, posts, and piles in damp ground; hence it enters largely into the construction of wharves, bridges, &c. It is largely resistant to the

attacks of marine borers and white ants. It is not a good timber for decking and flooring, owing to its liability to shell off.

In giving evidence before the Victorian Vegetable Products Commission, Mr. Richard Speight, then Chairman of the Railway Commissioners, stated that this timber and that of *E. hemiphloia* and *E. leucoxylon* were found best for railway sleepers, and of equal value. It is used for wheelwright's work, especially felloes, and also engine-buffers, &c.; in fact, it would be difficult to enumerate the multifarious uses to which this valuable timber is put, particularly in the colony of Victoria. According to Brough Smyth (*Aboriginals of Victoria*, i, 299), this is one of the woods used by the aborigines for making their clubs or waddies (Kud-jer-oongs or Gudgerons).

In the extreme western portion of New South Wales the variety known as "Creek Gum" is found, whose average height is 30 to 40 feet, and diameter 1 to 2 feet. Locally it is not considered of much use, except for firewood. But the limbs and branches make excellent charcoal; a charcoal-burner prefers it to any other wood for the purpose, and a local blacksmith pronounces the product excellent. It is the opinion of a good many people that red gum yields the best charcoal in Victoria for blacksmith's purposes.

Tests.—Some Victorian specimens of red gum were examined for tensile strength by Mr. F. A. Campbell (*Proc. Roy. Soc. Victoria*, 1879). His results are 14,000 to 21,500, 16,200, and 15,700 lb. per square inch. The last specimen was at a disadvantage, not being perfectly straight. They all broke with a long fracture. For particulars as to the conditions under which the experiments were conducted, Mr. Campbell's paper must be referred to.

In the Annual Report of the Secretary for Mines, Victoria, 1892, are some results of tests by E. R. Meekison. The pieces tested had been seasoned for nine months, and were all planed to 1 inch square. All the tests were made with the weight in the centres, and the ends free; the distances given were those between the supports.

From the tests, the following co-efficients of rupture were obtained:—Ironbark, 19; blue gum, 18; stringybark, 17; red gum, 7·5.

Following are the figures obtained with red gum:—

Tests 2 feet between the supports:—

60 lb. deflection $1\frac{7}{16}$"
120 lb. „ $1\frac{7}{8}$"
140 lb. breaking weight.

Tests 4 feet between the supports:—

20 lb. deflection $1\frac{7}{16}$"
40 lb. „ $2\frac{1}{16}$"
60 lb. „ 3"
80 lb. breaking weight.

Tests 6 feet between the supports:—

20 lb. deflection $2\frac{1}{4}$"
40 lb. „ $3\frac{3}{8}$"
60 lb. „ 5"
80 lb. „ $7\frac{1}{16}$"
85 lb. breaking weight.

A number of experiments on the tensile strength of dark red gum and pale red gum (both *E. rostrata*), by Baron von Mueller and J. G. Luehmann, will be found in the Baron's "Eucalyptographia," Decade 6 (under *E. globulus*). These are reprinted in a *Catalogue of Timbers of Victoria in the Technological Museum of Melbourne*, by Baron von Mueller (1885), and the reader is referred to either of these works.

A series of tests on the elasticity and strength of red-gum timber, by Mr. J. Lunt, Engineer for Existing Lines, Victoria, will be found recorded in the 4th Progress Report of the Victorian Royal Commission on Vegetable Products, page 490. They are far too long to quote here, but will be found to be valuable to engineers and others interested in this excellent timber.

And last, but certainly not least, are the results of tests of red gum from New South Wales, Victoria, and South Australia, carried out by Professor Warren, and epitomised in his valuable record of tests entitled "Australian Timbers." The results are too technical for reproduction here, but the engineer needs only to be reminded as to where they are to be found.

The Murray Forests.—Following are extracts from an interesting report made by Mr. Inspecting Forester Manton on the Murray Red-gum Reserves. The report was made as far back as 1889, but Mr. Manton does not wish to add to it:—

The largest, best, and most heavily-timbered of the reserves are on the Murray River, extending from the junction of the Ovens River to Campbell's Island. These areas contain red gum, pine, box, and occasionally a few myall and other trees may be met with, but not in sufficiently large numbers to be of any commercial value.

The chief and characteristic timber of the Murray Forest Reserves is the red gum, which is far in excess of any other description, and comprises fully two-thirds of the total area reserved for timber purposes. The pine forests are sparsely scattered through the reserves, and in most instances the matured timber has been removed some years back, pine being principally used by the Murray settlers for building and fencing purposes, and some considerable quantity has been exported by river to the Darling and Murrumbidgee. Many thousands of these valuable trees have been cut down for the construction of chock and log fences. This class of timber would be in great demand, were it procurable in sufficiently large quantities, as it is the best timber we have to resist the attacks of the white ant.

The remainder of the forest reserves are clothed with box and a few other trees, at present of little or no commercial value. On some of the reserves are small open plains of small area, but very few of the areas are fit for agricultural purposes, as they are subject to annual inundation.

Box intersects the various red-gum forests in belts of various extent, and, as has already been stated, comprises, with the exception of a few trees of other varieties, and small plains, about one-third of the whole of the Murray Forest Reserves. This timber is at present of little or no commercial value, except for firewood . . . but eventually an increasing revenue may be looked for from this timber.

Taking two-thirds of the Murray Forest Reserves, I estimate that there are at present two matured red gum trees to the acre fit for sawmill purposes on them; many fully-matured trees are valueless to the sawmiller, owing to their being pipy, spongy, or of crooked growth; this class of timber may be computed at about eight to the acre. Young, vigorous, healthy trees, varying in diameter from 16 to 20 inches, may be reckoned at from 6 to 8; there are a great number of trees of a lesser growth—in fact, it would be impossible to give anything like an approximate estimate of their number; in parts they are growing so thickly together, that it is questionable whether they will arrive at maturity unless some system of thinning be resorted to.

I may state that the principal demand for red-gum timber is chiefly by Victorian saw-mill owners on the Murray, who cut fully nine-tenths of our timber, which is used in that colony in connection with public works, such as railways, bridges, harbour works, and all constructions requiring strength and durability. The rest is used locally, or sent to the Darling and Murrumbidgee districts. Echuca is the main depôt and centre of the Murray timber trade. The principal means of transit for nearly the whole of the timber on the Murray forests is by river; the logs are hauled to the river bank in jinkers, thence floated down with the stream from the reserves above Moama in barges constructed for the purpose to long transverse outriggers, to which the logs are suspended, half in and half out of the water. The barges when drifting down the stream are kept in the middle of the river by means of a long chain dragging along the bottom of the river, attached to the stern-post of the barge; this plan of keeping the barge in the centre of the river was only discovered accidentally a few years back. From below Moama, when the logs are not sawn in the immediate neighbourhood, they are loaded in barges and towed up stream by steamers to the different saw-mills of Echuca, and the sawn timber is sent by railway to Melbourne, with the exception of the small quantity that goes by river to the Darling and Murrumbidgee.

The demand for timber from our reserves by the Victorian saw-mill owners has been gradually increasing year by year proportionately as it becomes scarce on their side.

There are nine saw-mill plants on the Victorian bank of the Murray fronting our forest reserves. I estimate that these mills are capable of turning out 71,000 superficial feet of timber every day. On this side there are but three, two of which are on Gulpa Creek, capable of turning out 11,500 superficial feet per day, and one on the Murray frontage, on the Barham State forest, county of Wakool, with a capacity of 6,000 superficial feet per day; this mill is owned by a Victorian company, so that we really have but two mills on this side owned in this Colony.

In view of the large quantity of red gum that is being taken from our forest reserves, it may, perhaps, be advisable to entirely close some portions of these reserves against timber-cutting. I estimate that at present fully one half of our mature red-gum trees fit for saw-mill purposes have been removed; young trees, from 2 feet down to 1 in diameter are very numerous; but under the present demand for timber it is questionable whether they will arrive at a sufficient size to keep up the supply before those already matured are removed; but from my long experience in connection with red-gum forests in this district, I am perfectly certain that under a judicious system of ring-barking the old and useless trees, so that others may take their place, and thinning out the saplings when the growth is excessive, so as to allow a rapid and vigorous growth of the best young trees, these forests can be made capable of supplying not only our own requirements, but to sustain an extensive export demand for all time, and prove a valuable source of wealth to the State.

The process of spontaneous re-foresting is going on at such a rate that I believe that I am safe in stating that there are at present ten times the number of young trees that there were fourteen years ago.

Size.—Up to a height of 200 feet, and a diameter of 4 to 6 feet, and even more. Acquires a girth of 3 feet 6 inches to 4 feet in thirty years. (Mr. James Shackell, M.L.A., Victoria.)

Distribution.—The red gum prefers the banks of rivers, or river-flats subject to inundation, rejoicing in rich alluvial soil of a humid character. In New South Wales the red-gum grows on the Murray and Edwards Rivers to the greatest perfection. The red-gum flats are subject to inundation, rendering these forests unsuitable for agricultural purposes, and hence they will remain forests for an indefinite time. Beyond the Dividing Range the red gum has a very wide range, being found on the banks of the Cudgegong, Castlereagh, Darling, &c. It is usually found near rivers, and is also sparingly found in the coast country, except from the Victorian boundary to the Bega district. In Victoria it is found on river-flats and open valleys in most parts of the Colony, and in South Australia it is likewise very extensively distributed. It is also found in South-west Queensland.

The way in which the red gum (yarra) usually marks the course of water was early observed by Sir Thomas Mitchell:—"The yarra grew here (Lachlan), as on the Darling, to a gigantic size, the height sometimes exceeding 100 feet. The yarra is certainly a pleasing object in various respects; its shining bark and lofty height inform the traveller of a distant probability of water, or at least of the bed of a river or lake, and being visible over all other trees, it usually marks the course of the rivers so well that in travelling along the Darling and Lachlan I could with ease trace the general course of the river, without approaching its banks, until I wished to encamp." [*Three Expeditions*, ii, 54.]

This useful tree has been introduced into several countries (chiefly through the agency of Baron von Mueller), with varying success. For particulars of most of the results, see Mueller's "Select Extra Tropical Plants" (Victorian Edition). For results in Assam, see Kew Report for 1879, p. 16; and for results in India, see Kew Reports, 1876, p. 23; 1879, p. 16; 1881, p. 12. Vilmorin, of Paris, has distributed a good deal of red gum in Europe. Some years ago I received from a correspondent at Oporto, in Portugal,

flowers and fruits of trees raised from such seed, with the report that the species does well in that country. The red gum has been planted by a number of people in California, and is favourably reported upon by the local forest conservator.

The following statistics from the Forest Department are interesting:—

RED GUM.

Forest Reserves, Murray District.

County.	Number of Forest Reserves in each County.	Area, in acres.
Cadell	6	58,802
Denison	19	14,553
Hume	10	7,607
Townsend	8	71,980
Wakool	19	94,003

RED GUM.

Murray District.

Years.	Number of superficial feet.	Royalty on timber.	Area thinned.	Cost of thinning.	Remarks.
		£ s. d.			
1883...	4,322,821	4,322 7 1	......	....	Area of red gum on The Murray about 225,000 acres. About 50,000 acres of a dense growth of red gum saplings which require thinning.
1884...	9,166,403	4,674 7 1			
1885...	3,975,541	2,077 17 5			
1886...	6,306,716	3,623 10 4			
1887...	6,767,946	3,812 5 8			
1888...	16,119,490	9,692 14 7			
1889...	13,817,893	7,874 17 1			
1890...	8,640,993	5,777 5 5	7,500 acres	£1,428 2 4	
1891...	8,571,748	6,015 1 11			
1892...	8,059,578	5,151 18 0			

Propagation.—By seed, which is a regular article of commerce.

Reference to Plate.—A, Flower-buds, showing beaked operculum; B, fruits; C, part of leaf to show venation (magnified).

Botanical Notes.

By J. H. MAIDEN,
Consulting Botanist.

Fibre of *Hibiscus heterophyllus*.

Mr. Hodgson, of "Sherwood," Macleay River, has sent to the department a nicely prepared sample of the fibre of this plant. He states that the Macleay River blacks used to call it "wyrrung." The late Sir William Macarthur says the Brisbane Water blacks used to call it "dtharangegange." We often call it "green kurrajong." It is a tall, lanky shrub, as a rule, though under favourable circumstances, or under cultivation, it grows to be a neat small tree. It has large white flowers, with crimson or purplish throat. The bark of this and of all species of *Hibiscus* contain more or less fibre. It is white, strong, of fine texture, and is prepared by maceration. This is one of the fibres of which the aborigines used commonly to make their dilly-bags, rope, fish-lines, twine for nets, and thread. Fibre of this species has often been sent to international exhibitions, and also of *Hibiscus splendens*, from the Richmond River, to a less extent. Mr. E. Palmer gives the native name of *Hibiscus panduriformis* on the Mitchell River as "Beeallo," and states that the bark is peeled off, cleaned, and twisted into twine, and into bags for carrying roots, game, &c. But of all Australian species of *Hibiscus*, *H. tiliaceus* of the Richmond River, near the coast, and coastal Queensland, has received most attention as a fibre plant. It is found in most tropical countries. The fibre was used by the aborigines for nets and fishing-lines. Some fibre produced in this Colony was pronounced by the jurors of the London International Exhibition of 1862 to be only fit for paper-making. It must have been crudely prepared, as the tree produces a good fibre in many parts of the world. Three or four years ago the Department of Agriculture of Queensland sent to London some fibre from the Daintree River, for report. The fibre "was roughly prepared by boiling in soda-lye, and rubbing with an old sack." The report was, "Good colour, moderately soft, but of no great strength, and fit only for jute purposes. It would, however, probably sell in large quantities, and we estimate the value to-day at £12 to £14 per ton in London."

But I am afraid there is no possible future for Hibiscus fibre in the world's markets; the utmost we can expect is to satisfy a small local demand for some inferior fibre. India is the home of Hibiscus. The products of different species are not always kept separate for trade purposes, but the principal hemp-yielding hibiscuses are *H. cannabinus*, which yields Bombay hemp, Ambari hemp, and Deccani hemp, and *H. sabdariffa*, which yields the Roselle. There are other species occasionally used as fibre plants. I note certain figures in regard to Bombay hemp. From official records it is stated

that the area under cultivation in the Bombay Presidency was, in 1885–6, 53,488 acres, in 1886–7; 87,957 acres, and in 1887–8, 71,588 acres. This refers to one species, to one Presidency, and labour of the cheapest kind, well accustomed to this sort of work, is employed. Also, the plantations are in the tropics, where fibre plants grow like weeds. It is facts like these which cause one to regretfully hesitate in recommending the cultivation of many fibre plants in New South Wales, and to throw cold water on the extraction of the fibre contained in many indigenous ones.

The Wild Parsnip as a Poison Plant.

With reference to the note in the November *Gazette*, page 913, as there is now reason to believe that the death of at least some of the cattle was caused by disease, the department is investigating the alleged poisonous nature of this plant, which was recorded as indubitably poisonous by high authority a number of years since. Pending the result of this investigation a full report (and illustration) of this plant will not be published.

Coffee Leaves as a Beverage.

A decoction made from the leaves of the coffee shrub has long been used in the Eastern Archipelago, and has more recently been introduced to the coolies in Southern India. A few years since it attracted considerable notice, and was recommended as a new article of import, to become a cheap substitute for tea. There seems to be no doubt that coffee leaves contain caffeine in sufficient abundance to make a valuable beverage, but the presence of an unpleasant senna-like odour would militate greatly against its popularity. As regards price, it is said that coffee leaves could be prepared (like tea) and shipped at 2d. per lb. as against teas at 6d. to 10d. There exists, however, the difficulty that depriving the tree of its foliage damages the crop of berries and injures the tree itself. On berry-producing trees, therefore, only the leaves obtained in the ordinary pruning operations would be available, and these would seem to yield so small a supply as not to be worth the cost of collection. Growing the shrubs for leaf alone would be a very questionable undertaking, but there appears to be no valid reason why, in the event of the berry crop failing, a portion, at least, of the leaves might not be gathered and prepared, if any means can be found of removing the objectionable odour. It has been urged that the product would be chiefly used to adulterate tea, but even supposing that such an adulterant could escape ready detection, the charge is not a very serious one.

A suggested New Material for Filling Pillows.

Mr. Forester Kidston, of Condobolin, writes:—"I forward samples of a weed which grows in great abundance in the Myall Plain country, on the Lachlan and Bogan. It is useless for stock, but the mature flowers rub up so fine that it appears to me that it would make an admirable substitute for feathers or kapok for filling beds, pillows, or cushions. It can be got in large quantities, and I will be glad to hear if you consider it of any commercial value."

The plant sent is *Craspedia pleiocephala*, F.v.M., and it belongs to the compositæ or daisy family, being a rather ornamental plant, with yellow heads of flowers.

Mr. Kidston's idea is ingenious, but I am afraid the article has no commercial future before it. The fragments into which it rubs up are botanically the individual flowers, and these individual flowers break up more or less into fine dust as they get dry, which is a serious drawback in a stuffing. Because of the smallness and "mobility" of the fragments, the stuffing could only be used for such articles as hassocks and solid cushions, *i.e.*, such as are not shaken, as pillows are, as, if the covering were sufficiently loose for the stuffing to shake about, it would settle towards the lower end of the covering. As a stuffing, therefore, it would have to compete with articles of the texture of chaff and bran. Most vegetable fibres for stuffing are exceedingly low in price, and the labour involved in reaping flower-heads would be far too expensive. The only possible opening I can see for the flowers would be in the event of their having any soothing effect in assuaging pain or inducing sleep, when used in the form of a pad or pillow (like hops and chamomiles), but, of course, this can only be proved by experience. We require more observers like Mr. Kidston to suggest means for the utilisation of our indigenous vegetation. The uses of very many plants are only awaiting careful observation and inquiry.

A Snatch Collection of Plants from the Bourke-Barringun Road.

By W.S.C.

Discovery of an Acacia new for the Colony.

Some little time ago, while visiting the artesian bores along the Bourke-Barringun Road, I snatched a few plants as I rode post haste through the country. Under the circumstances, no attempt to systematically collect was possible, but the plants secured give some idea of the vegetation of that part of the country. The collection includes Dodonæas, Eremophilas, Acacias, salt-bushes, and grasses such as are always more or less found in the district. *Acacia murrayana*, *Eremophila bowmanni*, and *Grevillea juncifolia*, are amongst the rarer plants, but the chief find is *Acacia patens*, F. v. M., which, Mr. Maiden informs me, is an addition to the flora of the Colony. It has previously only been recorded from the northern territory of South Australia, and the discovery of a plant new for New South Wales under the conditions of my trip indicates how desirable it is for people travelling in distant parts of the Colony to collect specimens of the vegetation, for we have much to learn in regard to the geographical distribution of Australian plants.

Portulaceæ.

Calandrinia (Claytonia) balonensis, Lindl.
Calandrinia (Claytonia) calyptrata, Hook. f.

Rutaceæ.

Geijera parviflora, Lindl.; "Wilga."

Sapindaceæ.

Dodonæa viscosa, Linn.
Dodonæa viscosa, Linn.; var *angustifolia*.
Dodonæa attenuata, A. Cunn.; var. *linearis*.
Dodonæa boroniæfolia, G. Don.

The *Dodonæas* are known as "Native hops."

Leguminosæ.

Swainsona phacoides, Benth.
Cassia phyllodinea, R. Br.
Cassia eremophila, A. Cunn.
Acacia patens, F. v. M. New for New South Wales. A plant closely allied to *A. siculiformis*, with which it has been carefully compared.

Acacia sentis, F. v. M.; " Prickly Wattle."
Acacia murrayana, F. v. M.
Acacia salicina, Lindl.; " Kooba," or " Native willow."
Acacia ? Oswaldi, F. v. M.; pods only, no seeds; " Umbrella bush."
Acacia pendula, A. Cunn.; " Myall."

MYRTACEÆ.

Calythrix tetragona, Labill.; " Fringed myrtle."
Eucalyptus largiflorens, F. v. M.; " Swamp box."
Eucalyptus terminalis, F. v. M.; " Bloodwood" of the interior.

COMPOSITÆ.

Olearia pimelioides, Benth; syn. *Aster pimelioides*, A Cunn.
Angianthus pusillus, Benth.
Helipterum moschatum, Benth.

SOLANEÆ.

Nicotiana suaveolens, Lehm.; " Native tobacco."

MYOPORINEÆ.

Myoporum acuminatum, R. Br.; var. *parviflorum.*
Eremophila bowmanni, F. v. M.
Eremophila sturtii, R. Br.; a " Bastard sandalwood."
Eremophila longifolia, F. v. M.; an " Emu bush," or " Berrigan."
Eremophila maculata, F. v. M.; an " Emu bush," or " Native fuchsia."

VERBENACEÆ.

Verbena officinalis, Linn.

CHENOPODIACEÆ (Salt bushes).

**Chenopodium murale*, Linn.
Atriplex spongiosum, F. v. M.
Atriplex halimoides, Lindl.
Kochia triptera, Benth.
Bassia paradoxa, F. v. M.

PROTEACEÆ.

Grevillea juncifolia, Hook. f.
Hakea pampliniana, Kipp.

GRAMINEÆ (Grasses).

Panicum prolutum, F. v. M.
Andropogon sericeus, R. Br.; " Blue grass."
Poa cæspitosa, Forst; var. " Tussock grass."
Glyceria ramigera, F. v. M.; " Cane grass."
Bromus arenarius, Labill.; a " Barley grass."
**Hordeum murinum*, Linn.; a " Barley grass."

Those marked with an * are not natives of Australia.

Experiments with Pulses.

By GEORGE VALDER,
Department of Agriculture.

Lentils (*Ervum lens*, Linn.)

Three very distinct varieties, viz., "Large Grey," "Egyptian," and "Spanish," were tried. They all came up well, and the former two grew very strongly, but the "Spanish" variety did not seem at home from the first, although it matured its seed, it had a very stunted and unhealthy appearance. Seven weeks after sowing all the varieties were in full bloom, and they were ready for harvesting about four to six weeks later. The following table will show the results obtained from each variety:—

No.	Name.	Seed obtained from—	Crop occupied the ground—No. of days.	Yield of dry pulse per acre. Bush. of 60 lb.
1	Spanish	Europe	91	9
2	Large Grey	"	78	41½
3	Egyptian	New South Wales ...	73	23

"*Large Grey.*"—This should prove by far the most valuable of the three varieties for cultivation in this Colony. On referring to the above table it will be seen that it gives a much larger yield than the other two varieties, and matures very quickly. The pulse also is much larger, being, when in the green state, fully as large as the finest garden peas. When dry the pulse is much flatter than a pea, but it is quite as big, whereas neither of the other varieties has seeds larger than a common vetch. I shelled out a dish of the lentils when they were quite green, and had them cooked and served up in the same way as green peas. They were very palatable, and should, I think, make a good substitute for green peas during the hot summer months. Dr. Marano, the Italian Consul, informs me that this lentil is largely used in Italy as a food. The dry pulse being either used in soups whole, or ground into pea-meal. Of late years the Italians resident in this Colony have been importing this pulse in fairly large quantities from Europe, there should therefore be a sale for it in Sydney. Being a very quick grower, requiring but little cultivation, and producing a large amount of foliage, it should prove a valuable plant for green manuring. The plot sown by me was ready for ploughing in six weeks from the time of sowing, and I roughly estimated the yield of green plant at that time at 6 tons per acre.

"*Egyptian.*"—A very hardy plant, but much smaller than the above, and foliage much thinner. When ready for harvesting the plants were covered very thickly with the small pods. Although it grows well here it is not nearly equal to the large grey variety in any way.

"*Spanish.*"—This sample was taken from a bushel of seed which the department imported from Messrs. Sutton and Sons, the well-known English seedsmen. Some 200 packets of the seed was sent to farmers in all parts of the Colony, and from what I can gather from reports received from them and my own observations, I consider that this is not a suitable variety for cultivation here.

PIGEON PEA (*Cajanus indicus*, Spreng.)

Two samples were tried—the red and the variegated varieties. The seed was sown in drills 4 feet apart, and the young plants were thinned out to 4 feet apart in the drill. At first they grew very slowly, but after a few weeks of hot weather they made rapid strides, and soon the plants in the two drills were touching. At this time they were fully 7 feet high, and were densely covered with foliage. They commenced to flower in February, and in about a fortnight later they made quite a pretty show, being thickly covered with bright yellow flowers. Towards the end of March I picked a quantity of green pods off them, and shelled out the peas and cooked them. They are of a very nice flavour, but are rather troublesome to shell out, both pods and peas being small. In April the plants were fairly well covered with pods, but they did not ripen well, the weather evidently being too cold. As a consequence, I could not get a fair estimate of the yield of dry pulse. The climate of Sydney is a little too cold for this plant, although I think that as it is a perennial it would ripen its seed earlier in the season the second year. On our northern rivers, and in several other of the warmer portions of the Colony, this plant should succeed very well. As a forage plant it should also prove of some value, especially in rotation with other fodder crops, such as maize, sorghum, &c. Six months after sowing the yield of green fodder was at the rate of nearly 12 tons per acre. I cut a quantity and gave it to horses and cattle, and found that they ate it with great relish.

LIMA BEAN (*Phaseolus lunatus*, Linn.)

I COULD only manage to obtain one variety of the Dwarf Lima bean, *i.e.*, that known as the Dwarf Bush Lima. This is a bean that is highly esteemed in the warmer portions of the United States of America, where they are grown in large quantities. With me the plants grew rather slowly until the weather became warm, when they grew quickly and soon began flowering. The pods grow in clusters of from four to ten on each stalk. The plants were not at any time more than from 10 to 12 inches high, and when in fruit they are almost borne to the ground by the weight of the large crop of pods. The pods should be picked as soon as they fill out, and beans then be shelled out and cooked and served up in the same manner as broad beans. I consider that for the warmer portions of the Colony this is one of the best summer vegetables grown. It simply revels in the hot dry weather. The yield of dry beans was very heavy, being at the rate of 37½ bushels per acre.

Wagner's Flat Pea (*Lathyrus sylvestris*, Linn.)

This sample was taken from a quantity which was imported by the department from England in August, 1890. The seed was distributed the following month to some 300 farmers in all parts of the Colony, and of these experimenters no less than 30 per cent. stated that the seed did not germinate. And yet a portion of the same seed which was sown by me with the other pulses two years later (8th October, 1892) came up very evenly, fully 60 per cent. of the seeds germinating. The plants, although looking perfectly healthy, grew very slowly, and at the end of nine months were not more than from 6 to 10 inches high. Of the fifty-four different pulses sown in these plots, this one was by far the slowest grower, and at the end of nine months only produced about half a ton of green plant per acre. Being a very deep-rooting plant, and a perennial, it was thought by some of the experimenters in this Colony that it might produce a large yield the second or third year, and that it would stand the dry weather well, but from reports received by the department it has certainly failed either in giving a good yield or withstanding the heat, and in many instances has died right out.

Villous Vetch (*Vicia villosa, Linn.*)

This proved to be a dwarf-growing vetch with short runners. The plants grew very quickly, commenced flowering in from six to seven weeks after sowing, and ripened their seed in from twelve to fourteen weeks. As a forage plant it is not equal to the common vetch, the yield of green plant being 4⅓ tons per acre, and the yield of dry pulse 23 bushels per acre. It has often been recommended as a good food-plant for bees, and from what I could observe it certainly bears out its character in this respect, as the plants, which were in flower from six to seven weeks, were continuously visited by bees in large numbers. When in flower the plants are very beautiful, being profusely covered with long racemes of pretty pink and white or purple and white flowers. I should not advise its cultivation on a large scale, but think it is worthy of a trial in small patches by beekeepers as a bee and forage plant.

Algerian Vetch (*Vicia calcarata*).

This vetch is one that will evidently stand great heat, but it does not yield well, and I cannot recommend it as a forage plant, there being so many species superior to it in every way.

Lupins.

Two packets of lupins, which had been received by the department from Germany, were sown with the other pulses. These two varieties were said to be the best for green-manurings. One was a yellow-flowering variety and the other a blue. As a rule, I believe that the small-seeded varieties have been found the best. These were both rather large-seeded varieties, and as far as I could tell are not equal to the smaller-seeded ones which are obtainable here, the quantity of foliage produced being very small. I made a sowing in the spring in order that I might be able to more quickly increase

the quantity of seed by making two sowings in the year. This crop was harvested in about three months after sowing, the quantity of seed obtained being about 1¼ lb. of each variety. I thus had 2½ lb. seed ready for sowing in the autumn, which is by far the best season. This plot should produce about 100 lb. seed, which is sufficient to sow an acre. Complaints have been received by the department from farmers that it is very difficult to obtain sufficient lupin seed from the local seedsmen for sowing large areas. This experiment will serve to show how easy it is to obtain a large supply at a small cost and within a short period of time.

This completes the record of the fifty-four species and varieties of pulses sown in connection with this experiment. As will be seen, these seeds were obtained from all parts of the world, and they were in many cases three or four years old. Yet when sown with care not a single species or variety failed to germinate. Nearly all of them came to maturity and gave very fair results, thus proving how well the climate of this Colony is adapted for pulse-growing.

National Prize Competition, 1893.

F. B. KYNGDON, M.R.A.C

CHAMPION FARMS.

OWING to the floods which prevailed during 1892 over the north coastal district the competition for the champion prizes was deferred for a year. It was at first intended that Mr. J. L. Thompson, Principal of the Hawkesbury Agricultural College, should act as judge, but, owing to his duties rendering a prolonged absence impossible, the writer was invited by the Minister to undertake the responsible post. The first farm was visited on 10th October, and the last on 14th December, so that over two months were spent in continuous travelling, 2,800 miles being traversed, of which 1,000 miles were by coach. So very much of interest was observed in farms that may be regarded as typical of all that is good in the agriculture of New South Wales that a description has been prepared for publication, in the hope that a wide encouragement may be given to the pursuit of agriculture. Moreover, by the courtesy of the competitors sufficient data was afforded to enable a short outline sketch of their careers to be made, which may serve to show that by means of genuine hard work, and the taking advantage of local markets, fortunes have been, and still can be made by farming. In many cases there may be but little actual cash in the Bank, since the funds have been invested in the farm which yields, however, good interest for generous treatment, and affords many advantages that would have to be paid for handsomely by residents in a town. A champion prize of £50 was offered for the best mixed farm under 200 acres, and also one of £50 for the best mixed farm under 200 acres and up to 1,280 acres in the whole Colony, open to all winners of first prizes in 1890, 1891, and 1892. The entries for the smaller farms comprised five from the North Coast, extending from the Hawkesbury to the Tweed, four from the South Coast, extending from the Hawkesbury to Cape Howe, and one from the table-lands south of the Hunter River Valley. The tables attached to this article give full particulars as to the entries, area, and marks awarded.

The schedule of points furnished by the Department was as follows:—

System of underground drainage	*50
Conservation of water and its economic application	80
Character and condition of fences and gates	40
Plan, character, and condition of homestead and of farm buildings	40
Kinds of implements used, condition, &c.	60
System of cultivation, rotation, &c.	80
State of crops as to cleanness and cultivation...	100
Productiveness of crops	50

* See tables, page 99.

System of manuring	*50
Conservation of manure made on the farm	50
Means used for conserving fodder	60
System of laying down grasses	20
Class and condition of live stock	50
Vegetable and fruit garden	25
Mode of book-keeping	20
Number and condition of subsidiary aids	80
Any new point of interest and commercial value, such as new crops, ensilage, &c.	20
General management with a view to profit	125
	1,000

In order to arrive at an acurate adjudication these heads were subdivided, as shown in the tables, p. 99–104, so as to give full value to each competitor. By their study it will be seen that the highest scorers made more points, because in their methods of farming they had so many more strings to their bow. The farming throughout was of a very high-class, reflecting great credit to the competitors. There can be no doubt but that these farms exercise an influence for good in their neighbourhoods, more especially since having entered for prizes offered by the Government they have been distinguished as winners.

Mixed Farms over 200 and up to 1,280 acres.

Order of Merit.

	per cent. of points.
Worboys T. C.	91·18
Wilford W. H.	90·31
Warden A. F.	88·22
Mason Dr. H. W.	87·36
Godfrey G., senior	86·73
Sommerlad J. H....	83·26
O'Meara W.	79·77

George Godfrey, senr., Gocup, 13 miles from Gundagai.

South Tableland District.—Place, No. 5; points, 86·73 per cent.; arable, 73 acres; pasture, 226 acres; homestead, 1¾ acre; orchard, ¼ acre; total, 300 acres.

(10 October, 1893.)

Mr. Godfrey's farm occupies principally alluvial flats at the foot of Mount Minjary, between Gundagai and Tumut, and comprises 60 acres of reclaimed marsh, devoted to cultivation; 30 acres of gentle hill slopes, suitable for ploughing, with a thin but fair basaltic soil, and 210 acres of steep mountain, useful for pasture only—in all, 300 acres. High ranges at the back shelter from strong winds, and their soakage supplies the stream that made in days gone by the marsh. The main Gundagai-Tumut road passes through the property, the first-named place being 13 miles distant and Tumut 8 miles. The haulage to Gundagai railway station is moderately heavy, some steep hills having to be surmounted. Many years ago, in the gold-mining period,

* See tables, page 99.

before the days of the railroad, the Tumut district sent produce to Albury, Lambing Flat (Young), and other distant centres, but the rail has altered matters, besides which these places now supply their own wants. The Tumut market to-day is distinctively a local and district one, and the farmers are looking out for other centres and for other methods of disposal than now exist.

Mr. Godfrey is a native of Bedfordshire, England, and had some experience in agricultural labour prior to emigrating. He had made and laid pipe-drains, and had seen the great drainage system of the Fen country of Lincolnshire, and this influenced him in taking up a discarded marshy spot. Thirty years ago, dating from February, 1894, he paid £230 for the goodwill and improvements on a selection of 160 acres, forming the nucleus of his farm. The improvements consisted of a small slab-house and a 10-acre paddock fenced, but not cleared, whilst so unpromising did the 60 acres of marsh appear that neighbours fully expected another relinquishment. The geological formation of the district is Silurian slate, backed by high granite ranges; the slate foot-hills slope at first steeply down as sharp ridges to the Tumut valley, and vary from 300 to 500 feet in elevation. They are covered with a thin soil, and the soil of the lower gentle slopes is a much weathered débris, in which disintegrated basalt forms a part. These red soils are sandy, porous, and fertile. The alluvial flats have much of this red soil with layers of clay and slaty débris. The marsh is caused by an upper layer of tenacious clay, beneath which the soakage finds a way through the porous red soil, and bursts up through the clay as treacherous crab-hole springs, into which many oxen sank when numerous teams used to camp in the olden days. The marsh was then a bog of black peat, and tall impenetrable masses of reeds.

Drainage was the first consideration, and begun by digging a main ditch at the junction of the marsh with the hill slopes, so that the soakage might be tapped. Trenches 3 feet deep were next cut across the marsh, and draining into the main ditch. So rough was the coarse reed foliage and sour grass tussocks that it was necessary to mow a way through them prior to cutting the trench. The crab holes were attacked by a special trench, the bottom of which was filled in with rough slabs, forming underground drains that act as well to-day as they did thirty years ago. Year by year more and more of the marsh has been reclaimed, first by the labour of Mr. Godfrey alone, and then assisted for a few years past by his two sons. A small final portion awaits treatment, and shows to-day what the original condition must have been. After drainage the soil becomes a light-working, black, sandy loam, lying 3 feet above the level of the running ditches, so that there is always capillary moisture, but after wet the land poaches freely wherever troddened; if turned up wet the clods remain for a long time hard-baked, which precludes a fine even tilth, but the growth of the crop is not interfered with. Rain-water is conserved in an underground tank for household purposes, and there are natural supplies of water in most of the paddocks. The farm, moreover, affords a lesson in practical irrigation, for by temporarily blocking the main ditch the water can be thrown up into shallow channels that command the lower levels of the flat, and by this means crops of maize have been irrigated in trying seasons. The same can also be extended to the orchard and vegetable garden.

The fences throughout are serviceable and good, being two and three rail, two wire and three rail, also one wire and three rail, the wire being added to strengthen fences weakened by age. There are some gates, and existing slip-rails will give place to gates as circumstances allow.

The residence is of red brick, containing seven rooms, and was built ten years ago at an outlay of £650. The kitchen is separate, and of equal date. In front there is a small flower garden, and at a little distance a moderate-sized orchard and kitchen garden. The farm buildings are arranged to afford every convenience for working, and are distributed apart to avoid any risk of fire. They are throughout of slabs, with round timbers, and roofed with iron or bark. The barn, 60 feet by 20 feet, is occupied as an oaten hay store, and in it are many machines worked by horse-gear outside. There are also a cart and implement shed, tool-shop, store-room, calf-pen, and milking yard, new five-stall stable of superior finish, the old stable, piggery and yard, double stockyard and windlass.

The implements comprise two one-furrow ploughs by Ransome and Howard, two-furrow plough by Howard, wheel harrow by Howard, one set of iron harrows, wood harrow for breaking down rough ground, small disc harrow for covering in seed, iron horse-hoe with various shaped feet, wood roller, maize (horse) drill, broadcast seed-sower for use on a cart, Robinson's of Melbourne back delivery mower, Hornsby's string binder, two drays, and a buggy. In the barn the following are driven by shafting from a Bentall's horse-gear outside: a large maize-sheller, chaff-cutter, and grindstone. Mr. Godfrey attends to his own repairs, and has a tool-shop well supplied. The selection of implements is good, and they are properly cared for.

The cultivation of the farm is as follows:—Sixteen acres of oats and wheat mixed for hay on a once heavily-timbered flat, 15 acres of late sown oats for hay on the original marsh, 2 acres of minor crops, such as 1 acre of maize, ¼ acre potatoes, ½ acre millet, melons, and amber cane, and ¼ acre of pumpkins in odd pieces of land. Two acres of "Chevalier" malting barley has been sown as an experiment, the seed being obtained from Mr. Coker, of Cootamundra, and 10 acres of maize—in all, 45 acres of cultivated land. On the fallows grass is allowed to grow for a short period, and 12 acres are due for wheat, and 15 acres for maize next season—in all, there are 27 acres of this pasture. The natural herbage of the nearly cleared slopes and hillsides amounts to 226 acres, and a portion has been under cultivation during past years. The total area of the farm is 300 acres, of which 72 acres may be classed as arable. The rotation is based upon wheat after a fallow followed by hay—oaten or wheaten. The object of the fallow is to clean the land every third year, but on the 60 acres of alluvial flat it is only introduced when the land really wants cleaning, otherwise maize is followed by hay continuously. The land is prepared for wheat and hay by one main ploughing, the seed is broadcasted, harrowed in, rolled in spring, and harvested by a string binder, carried to the hay-shed, or stacked at the homestead. The wheat is thrashed at 1s. per bag by a travelling 8-horse pegdrum machine, the owner of the thrasher supplying horses, feeder, and driver, whilst extra hands and rations for the whole are supplied by the farmer. A steam tackle would do in one day all the wheat grown on a small farm, and there are one or two sets in the district. A small area of potatoes and pumpkins are grown for home consumption, and the surplus is sold locally.

Land for maize receives one main ploughing, and the employment of harrow and scuffle to bring it to a fine tilth with the further use of Howard's wheel harrow as the best tool, in Mr. Godfrey's opinion, to work up weeds and clear off rubbish. The corn is planted by the horse-drill in rows 4 feet apart, the varieties preferred being "Horse Tooth" and "Early Profit." Constant cleaning is pursued by horse and hand hoe, particularly in the early stages of growth, and sheep are run through the crop when nearly ripe as a further cleaning process. The cobs are husked in the barn, the husks

being picked over by stock, and used for litter, and the cores for fuel. When a hay crop follows the stalks are rolled down and ploughed in or burnt off for a succeeding crop of maize. The chief weeds of the farm are sorrel and thistles, and the former is kept under by the summer fallow every third year. If in cultivating the land there be many such weeds one or two shallow ploughings are preferred. Through the neglect of neighbours and the state of the roads, thistles and briars invade Mr. Godfrey's land. The yields per acre, taking an average of many years, are as follows:—Oaten and wheaten hay on the slopes from 1¾ to 2 tons per acre, and on the alluvial 2½ tons per acre. Wheat averages 20 bushels, with extremes of from 16 to 35 bushels per acre; maize, 50 to 60 bushels, with extremes of from 30 to 80 bushels per acre.

The making of manure is attended to by throwing maize-cores to the pigs, the gathering of yard-waste and stable-dung into one heap. In the cow-yard, straw is trodden down; poultry droppings are saved for special use in the garden; the farmyard-dung is used to equalise poor patches, and the land affords indications that a more general application is needed.

Mention has been made of the conservation of oaten and wheaten hay. Rye-grass was one year laid down and ploughed up since then. No artificial grasses have been sown, but rye-grass is still to be met with in the pastures. The natural grasses are nutritious, and give good feed to the sheep on the steep hill-sides, which extend over an area of 226 acres.

The live-stock comprise 15 horses, 36 cattle, 150 sheep, 15 swine, and 100 head of poultry. The eight farm-horses are of a good active type, and two are young draught horses coming on into work. There is also a pair of well-bred buggy-horses, 2 saddle-horses, and 3 young light horses. The milch-cows number 9—springers, 6; yearlings, 5; calves, 15; and a bull; total, 36,—the whole forming a useful type, in which Durham predominates. The sheep are breeding-ewes, chiefly merino, and a few cross-bred, a flock being kept for grazing surplus feed. Bacon is cured for home use, and live pigs sold. The stock comprises a Berkshire boar, 2 sows, and 12 young pigs. The poultry were of mixed breeds.

The kitchen garden and fruit-trees merely supply sufficient for home requirements, save a few apples and quinces are sold.

Bookkeeping consisted in a record of sales and purchases.

A small quantity of experimental wheat was growing from seed supplied by Mr. H. D. Coker, of Cootamundra, consisting of 3 bushels of Smith's "Nonpareil," 1 bushel of "Lambrigg," and some "Allora Spring." The district is not entirely free from rust, but, unless on the alluvial flat, it is not a great evil. When it was profitable to grow tobacco a few years ago, some 10 acres of the alluvial flat was let off to Chinamen, who produced several tons. A little amber cane is being tried this season.

The subsidiary aids may be enumerated as co-operative family labour,—Mrs. and the two Miss Godfreys attending to the dairy, including milking and butter-making, as well as the poultry; use of flour from home-grown wheat; letting out of the string-binder (£25 per annum being so earned); home repairs, carpentering, and engineering; the keeping of a produce store on the main roadside; salt meat, also bacon and hams cured for home use; sales of 10 lb of butter per week, apples, quinces, and potatoes.

The points of interest are the drainage of a marsh, extensive growth of hay crops, and sales of produce through channels attached to the farm.

The general management, with a view to profit, has been to grow horse-feed for local sale, there being a produce-store on the farm, and a son-in-law established as a produce-dealer in Tumut, so that a safe outlet is secured for

this particular farm. The 60 acres of alluvial form the chief cultivation area. The arable land is cropped on a three years rotation, viz., a grain crop, a hay crop, and a rest as pasture. The work of the farm is done by two men, eight horses, and a good selection of implements. The cattle are evidently the least profitable of the live-stock when their present low values are considered, whilst the flock of sheep kept to clear off surplus feed might be increased in numbers. Poultry and swine pay well. Two horses are sold on an average each year, and young cattle as occasion offers. The prices got are as follows:—Hay, £3 10s. per ton; maize, 2s. 9d. to 3s. per bushel; wheat, 3s. per bushel; feed oats, 3s. per bushel; hay chaff, £4 per ton. The annual turnover amounts to £270, to which must be added the household expenses of five adults and improvements added to the farm. The original capital of £230 was spent in the purchase of the goodwill of the original selection, and only the balance of certain payments are now owing to the State. The improvements, buildings, live-stock, and farming plant may be taken at £3,000, and a family of ten, including the parents, have been supported by the farm amidst every comfort. The results of Mr. Godfrey's farming may be summarised as the building up of an occupation well fenced, drained, and cultivated, with good serviceable buildings and a neat homestead, by means of his own labour, assisted of late years by his sons.

Dr. H. Wharton Mason, Tumut.

South Tableland District.—Place, No. 4; points, 87·36 per cent.; arable, 219 acres; pasture, 228 acres; forest, 320 acres; orchard, 3½ acres; homestead, 2 acres; total, 772 acres.

(11 October, 1893.)

Dr. Mason has entered upon farming as an investment, finding leisure, amidst a busy life, to give a general superintendence. From time to time, as opportunity occurred, freehold areas have been purchased on the rich alluvial flats within a mile or two of Tumut. On these fertile lands, subject to overflows which replenish the soil by the deposition of silt, continuous crops of maize, pumpkins, and cereal hay are grown, and when the market again proves favourable a large area is ready to be planted with tobacco. Quite recently, 400 tons of leaf were stored in Tumut awaiting sale, but the excise duty is blamed for manufacturers nominally preferring American tobaccos, although it is suspected that stocks of Colonial leaf, acquired at depreciated rates, enter largely into their output. The great art of tobacco-making lies in the management of the curing-shed, and, in the opinion of Mr. Sutherland, the expert of the Department of Agriculture, the Tumut soil will grow good plants, but something more than the open Chinese pattern of shed is needed. Hitherto, the growth of tobacco has been in the hands of Chinese, who can seldom be induced to alter their traditions of cultivation. Their ways of curing lead to inferiority, and the large accumulations of leaf came from their sheds. Their methods of intense cultivation depend on well-watered, fertile lands, and, in their competition for such, landlords who hold Tumut alluvials have reaped much benefit; in fact, it is a question whether altogether too high a rental is not entertained, and large areas are kept in pasture, which, if rents were lower, could be readily leased. To-day the Tumut tobacco industry may be said not to exist, for disease has well nigh exterminated the seedling plants, although spraying affords a remedy not yet availed of. Dr. Mason is, however, prepared to grow and cure tobacco whenever the product can be sold at a profit, or when co-operative support is given to a proper curing-shed.

The local demand for maize is limited, and further efforts are needed to open up markets in the south-eastern districts of the Colony. The Sydney market can only be reached by 285 miles of railway carriage, and is availed of if prices are favourable, Dr. Mason and other growers having made top prices for picked samples. The doctor is, however, prepared to fall back on fattening swine in conjunction with his butter-factory. The establishment of a complete cheese and separating plant, worked by water-power, was due to the necessity of most profitably utilising the food which the rich alluvials are capable of growing. In order to do so, a dairy herd is being established which will yield the maximum of rich milk, but it takes great skill and years of culling to bring about an ideal result. The cows and swine together will absorb what food can be produced. Oaten and wheaten hay is being largely grown, and, by ensilage, stores of green stuff are to be rendered available, particularly when the crop is compounded of vetches and oats, with beans and peas, as is proposed. It is a feature of this farm that large supplies of fodder can be relied on, and it is important that storage in stack or silo be made for summer use. Perhaps no climate and soil can be better suited for this scheme of farming.

The Tumut Valley has been scoured out of the soft Silurian slates during the course of ages. On either side high granite ranges hem in the slate formation, and the detritus washed down from an extensive watershed has formed the fertile alluvial flats. Hydraulic mining is yearly sending down a vast bulk of silt, so that lagoons are filled up, meadows raised, and fences disappear. Gilmore Creek bounds one of Dr. Mason's farms, and silt from this source can be laid at will on many of the pastures. Bumbowlee Creek passes through another farm, but its silt is derived from natural sources. There are four distinct farms lying at a little distance from each other. The acreage of the Bumbowlee Creek farm is 109½, consisting of 28 acres of oaten-hay land, 52 acres of tobacco flat, and 29½ acres of hill-slope grazing country; it was purchased five years ago. On the Tumut River there are 17½ acres, all alluvial flat, and including an orchard of 3½ acres, and purchased two years ago. Another area on the Tumut River extends over 125 acres of alluvial, devoted to the growth of maize. The largest farm is Gilmore Creek, where the head-quarters are. It comprises 200 acres of flat and 300 acres of hillslope recently ringbarked. In all, there are 772 acres, composed of 219 acres arable, 230 acres pasture, 3½ acres orchard, and 320 acres forest.

The large proportion of alluvial land, nearly 400 acres, is subject to overflow, and where the land recedes from the high banks next the streams, flood-waters may lie for a time and form some permanently wet pastures and some lagoons. In the aggregate a great many acres have been surface-drained by long contour plough-furrows, and by deeper ditches. By similar methods other areas have been laid under waters of irrigation, so that both drainage and irrigation have been attended to.

Through having bought from time to time contiguous small properties, the fences proved too numerous, and many divisions have been thrown into one, so that larger areas may be ploughed. In all cases the fences were in good order, and instead of burning off timber from the forest land a large supply of posts and rails has been got out. Moreover, in slack times the dead timber is to be drawn to the saw-mill and cut for town fuel supply. The roadways across the alluvial flats have entailed much attention to render them dry, and many wet spots have cost money to make passable.

Another feature of buying up small farms is that each had its homestead. The farm buildings at Bumbowlee Creek were not long ago destroyed by fire,

but a fair-sized farm cottage is in good order and tenanted. On the orchard plot on the Tumut River there is a superior four-room cottage, occupied by one of the hands. The barn, 40 feet by 20 feet, is of horizontal saplings with iron roof, and may be used for tobacco-curing. There is a similarly-constructed shed 40 feet by 8 feet for corn, as well as a windlass and yard. On the tobacco-grounds of the Tumut River property there are numerous but inferior dwelling-places occupied by previous Chinese tenants, and now by permanent or temporary hands. Two specially-constructed tobacco-sheds ave been put up, open on all sides, with round posts and iron roof, the argest measuring 200 feet by 30 feet by 18 feet high, and costing £120 and £250 respectively. The plan was on the best local system, but Mr. Sutherland, the tobacco expert, points out that quality of leaf cannot be cured without proper control of ventilation and the regulation of heat, which might be secured by double walls and a ceiling. The main homestead is at Gilmore Creek, where an old flour-mill has been adapted to a dairy, and the water-wheel repaired at a cost of £80 for woodwork alone. By this means 10-horse power is utilised for the butter factory, food-preparing machinery, and saw-bench. The miller's cottage is occupied by the butter-maker, and a large iron-roofed shed 170 feet by 40 feet gives accommodation to 32 milking-bails, and as many cows can be housed in winter, barn storage for hay and maize, chaff-cutting appliances and implement shelter. A piggery adjoining, 40 feet by 25 feet, contains 8 breeding-pens, and the surrounding paddock of 14 acres is about to be made pig-proof.

The implements comprise 7 one-furrow ploughs, horse-hoes, and 4 scarifiers, including the "Planet," 6 harrows, and roller and corn-rake, Howard's string-binder and reaper, 2 maize-shellers, Hunt's large chaff-cutter and corn-cracker, elevator and chaff-bagger, 90-gallon Alexandra separator, Kiama 80-lb. churn, Helical butter-worker, complete cheese plant by Zingel of Kiama, 2 large coppers for heating water, fan to butter cool-store, rotatory pump and hose in case of fire driven by the 10-horse power water-wheel, circular saw bench, blacksmith's forge and tools for general repairs (heavy repairs done by tradespeople), 1 3-horse waggon, 2 drays.

The system upon which Dr. Mason farms is, to grow maize and oaten hay with a summer rest, stock running on the stubbles. Clover springs up luxuriantly, and constitutes the nitrogen-gathering legume on these stubbles. For instance, at Bumbowlee, the oaten hay of the previous season was put up in five circular stacks, said to be the first in the district. On reaping, a good deal of grain was shattered, which, however, afforded a luxuriant feed to 130 head of dairy stock, who were grazing preparatory to the land being planted with maize. At the Tumut River farm 125 acres were to be in maize this season; the land ploughed up well, clover having grown thickly, with a good sprinkling of ranunculus. The maize crop immediately preceding gave an increased yield, as a result of constant horse and hand hoeing, the "Planet" cultivator giving much satisfaction. These lands are subject to overflow, and the silt deposited replenishes fertility, so that no rotation is necessary. Wheat grows too luxuriantly on these alluvials, so oats are preferred for hay. Throughout the maize, pumpkins are grown for pig and cattle food, and every effort is made to secure thorough and clean cultivation. The character of the corn and hay produced is excellent.

The value of manure is recognised on this farm. Nightsoil is delivered by the town authorities; from the piggeries and cow-yards a large quantity of dung is gathered; several tons of bones, a legacy left by a previous butcher tenant, are about to be rendered friable with quicklime, and a deposit of silt can be put at will over large areas. In a dairy farm manure is distributed

by the grazing stock, and in order to accumulate dung it is intended to winter sixty head on the Gilmore farm steading.

On a farm where such large quantities of fodder are conserved, ample accommodation is provided in the great tobacco-sheds on the Tumut River farm, in the barn at the orchard, in the great shed at Gilmore Creek, and in the five round stacks at Bumbowlee. The Howard's string-binder cuts the crops, and at Gilmore a large chaff-cutter driven by water-power prepares food for the stock. The previous year some silage had been successfully made on a plan suggested by Mr. Argyle M'Callum, of Yass, whereby ordinary fencing-wire is utilised, and the pressure applied by a miniature windless on each strand. The drum is made out of round timber 18 inches long by 6 inches in diameter. Through an auger-hole in the centre the wire is passed, and one turn, given by handles through holes at each end, causes the wire to take two laps. So simple and inexpensive is this plan that no farm should be without a silage stack. Some 14 acres of the Gilmore flat are to be put into lucerne and sorghum.

No system of laying down grass has been attempted, because rye-grass and clover have taken such hold on the flats that the result cannot be improved. It is worthy of notice that grass seeds have been scattered on poor leas, and special pains have been taken to keep the pasture lands dry, level, and healthy, by means of ditches, plough-furrows, and silting.

The 30 acres of hill slope at Bumbowlee were covered with a rich growth of natural grass, in which there was a sprinkling of natural-sown rye-grass, working its way up from the flats, where, with clover, it formed a luxuriant growth. The pastures at Gilmore, extending over 200 acres, were devoted to the dairy herd. One area recently acquired had once been under the plough, and, from close-feeding, showed poor pasture; it is to be cropped again after dressing with nightsoil and bones. An adjoining pasture of 16 acres is to be cut for silage, and then its low levels silted up. Another pasture adjoining of 42 acres, that has to be grazed bare, is to be rested, and then cut for silage, to be followed by a grass-hay crop, and kept for summer-grazing. A 4-acre paddock next the dairy is to be heavily manured, sown with tares, oats, peas, and beans for ensilage, then silted and put into green barley, as it is handy for feeding the cows. The forest country of 300 acres on the Gilmore Creek property, occupying slate foothills, is fenced off from the 200 acres of flat, and was rung eighteen months ago. On it the horse stock are run, and young cattle turned out to pick up their living, the unremunerativeness of cattle rendering such a cheap method necessary.

The live stock number 50 horses, 309 cattle, 60 swine, and 66 head of poultry. The 50 horses comprise 36 thoroughbred, for which Dr. Mason has a partiality, and several beauties are to be found, also mixed carriage and saddle horses. They are well looked after, and sales add to the annual turnover. There are 14 plough-horses, of a good active type.

The key to Dr. Mason's system of farming is the keeping of dairy stock to utilise the luxuriant yields of pasture, fodder, and maize on the alluvial flats. Since profit on dairying depends on the milk-yield, an initial difficulty had to be met of building up a profitable dairy herd. The average Tumut cattle are of mixed origin, with Durham predominating, chiefly of the very best beef type, but no systematic improvement of the milking qualities has been attempted. It takes years to collect a good milking herd; heifers from full milkers have to be tested, and young and old rigorously culled; and, above all, the influence of the sire is paramount. Dr. Mason has ever been ready to buy up small dairy herds and individual good milkers; recently he

acquired 60 head from a neighbouring dairy-farm. In order to introduce a Jersey element, he is forming a pure-bred herd. The bull, "Neat Boy's Pride," was procured from the Wood-Mason herd of Victoria, and 10 cows from the Wallace strain. The bull has had several months service with 60 cows of the main dairy herd, and already his influence is being shown, and there are 4 pure-bred calves of great promise. The Jerseys number in all 15 head. The ordinary stock comprise 3 bulls, 65 cows in milk, 105 springers, fosters and dry, 70 yearlings up to two years, and 51 calves up to four months, making a total of 309 head. The three bulls are of first-class Durham type, being from McIntyre of Wagga Wagga, and amongst the cows Durham predominates. All were in a very healthy condition. The disposal of the culls, fats, yearlings, and calves is a perplexity since prices rule low—£1 for an 18-month-old animal that has eaten food to four times that value; and, in fact, it is cheaper to kill a calf at birth for pig-food than to rear it. Calves are assisted with skim-milk, and when weaned are sent to pick up a living on the forest hill-land. No sheep are kept, but it is a question whether it would not be wiser to discard all male cattle at birth and run sheep in lieu on the forest land. Wool always commands a value, and the Tumut district ought to turn out superior "freezers" for export. The chief want is a freezing-works on the main railway line, which would benefit many other districts besides Tumut.

The keeping of swine is closely allied with dairying, and Dr. Mason has made preparations on an extensive scale. The neucleus of the herd is Berkshire, there being 3 boars, 15 breeding-sows, and 42 young pigs. Large piggeries, paddocks (14 acres), and food-preparing plant are at hand, and the enormous bulk of maize and lucerne that can be produced should render the enterprise most profitable. A few head of poultry are kept—6 turkeys, 20 ducks, and 40 fowls.

A few vegetables are grown for home use, but no feature is made of gardening. The orchard of 3½ acres was full of strong, growing, thriving trees, but the previous tenants were Chinese, and therefore no attention had been paid to pruning and general orchard work.

The books of account contained records of sales and purchases from the first, and indicate that at least £9,000 had been invested. Proper books relating to the dairy branch were kept by the man in charge. The labour of the farm was wholly hired. There was a farm superintendent and a dairy manager, whilst extra labour is easily got at the rate of £1 per week, board and lodging provided. The average number employed is from two to four, and three milkers are expected to strip twenty cows each.

As a subsidiary aid the dairy stands prominent. The purchase of the mill, repair of the water-wheel, erection of the enormous shed, fitting up of a 90-gallon separator plant, obtaining a set of cheese appliances, and securing the services of a competent manager have entailed a large outlay. The appliances are ready to deal with milk of 200 cows, but the opportunity offered to the farmers of the district has not been realised. The sixty-four cows in milk in October would be rapidly supplemented as summer is entered upon. A retail milk trade was conducted, with two deliveries daily, and 3d. per quart charged, but it is customary for families to keep their own cows, so that there is only a limited field for town supply. The market for the butter lies west, and the storekeepers of the Darling will have to be enlisted in its distribution. Tumut lies off the railway line like an oasis, and whilst distance militates against Sydney as a market for its products, the same is a factor in its favour when the Riverina and western trade is considered. There should be no difficulty in making a market for

good butter, bacon, and cheese. Cheese-making had not been entered upon, but a small plant had been purchased. Bacon-curing had also to be commenced. Tobacco-culture has been fully noticed, and when the difficulty of proper curing is overcome the yield from these choice alluvials should prove very remunerative.

The points of interest may be summarised as drainage, irrigation, and silting, extended oaten-hay production, and tobacco-culture when the market is profitable; the foundation of a large dairy herd and the introduction of Jerseys, the establishment of a butter factory, and provision made for pig-rearing on a large scale; also the growth and conservation of fodder by barn, stack, and ensilage.

The general management, with a view to profit, is based upon getting the fullest supply of produce from rich alluvial land and marketing it by means of butter, bacon, and cheese. The situation of Tumut is favourable for the supply of such to Riverina and western markets, whilst the distance from Sydney necessitates other distributing centres being relied on. The enterprise is so great as to need undivided attention, and the skill shown by Dr. Mason in planning it warrants the firmest hope in its ultimate success.

T. C. Worboys, Wattle Grove Farm, Spring Hill, near Orange.

South Tableland District.—Champion Prize Farm; points, 91·18 per cent.; arable, 170 acres; pasture (fallow ridge) 61 acres; homestead and orchard, 5 acres; total, 236 acres.

(21 October, 1893.)

Wattle Grove Farm is distant 1½ miles from Spring Hill Station, on the Western Line, and 11 miles from Orange. The land has a gentle slope towards the south, over the higher portion, but the larger area is very nearly level, and in one part it lies somewhat low. The climate of this farm, which stands 3,086 feet above sea-level, is at times during the winter very bleak. The westerly winds in spring are searching; hot winds, however, seldom prevail, and misty rain is pretty regular throughout the year. Spring is later than in the coastal districts, and the dry westerly winds, with absence of rain which prevailed just prior to my visit, began to tell upon the vegetation. The country rock was evidently slate, here and there appearing in hills of low elevation, but overlaid with detritus from the disintregation of the great basaltic overflow which geologists consider to have burst forth long ages ago from the Canoblas, whose high hills are distant about 12 miles. The soil is of a light red tint, and of a sandy, friable texture, fit to work in all weathers, and the growth of clover showing it to be of natural fertility. In the lower levels, where the basalt cap has been denuded and slate rock disintregated, a resulting white clay is deposited, forming a sandy clay soil, which, if drained, works freely, but holds the water otherwise. The fertility of these soils quickly falls off, so that a rest or a good rotation is necessary. If manured, the improvement is magical, and increased returns most satisfactory. In 1863, when Mr. Worboys took up his selection, the Western Line extended only as far as Raglan, a few houses constituted the township of Orange, and it took three days to cart wheat from Springhill to Bathurst, the market-town of the district. Immediately before Mr. Worboys selected this farm, he was camped with Mr. W. H. Newman on land that the next day was worked as the first and richest claim on the Lucknow gold-field. The excitement was great, and it was a question whether he should pay £1 for a mining claim or take up a selection. Having had six years of mining with varied success, the settled life of a farmer proved the more attractive.

Sir John Robertson's Land Act was then in its early days, and with a knowledge of farming gained when as a boy he worked on an English farm, the choice was made, but he had no money. With skill as a miner, contracts were undertaken to sink wells, and at the end of six months' time he became the possessor of £25 5s. The gold was paid as a quarter-deposit on a 100-acre selection, and the 5s. remained as working capital. Mr. Worboys had necessarily to sell his labour, and by dint of hard work in many contracts, either well-sinking or clearing land, kept himself, and at intervals cleared portions of his forest land. Little by little larger breadths of wheat were got in, a house of turf put up, a well 70 feet deep sunk, and the grain was sold in Bathurst, a week being occupied going there and back. This slow progress continued for six years, and it occurred to him that as there was only one steam thrasher in the district, money might be made if the possession of one could be but financed. The matter was laid before Messrs. Dalton, of Orange, who, reading the honesty of the man, agreed to supply an 8-horse power set of Hornsby's finishing steam tackle, costing £810. In the first season (1874) it earned a large sum, and in three years the whole debt was paid. Other improved implements were got on similar terms, additional forest land cleared, and more wheat grown. The year 1882 was exceptionably favourable to the Orange district. Elsewhere drought prevailed, so that wheat and hay which did well that season sold dearly, and this farm of less than 100 acres returned more than £1,200 for wheat alone. The next two years were also favourable, and as an outcome, instead of banking the money, the present substantial brick residence was erected, at a cost of £900. Previous to that, however, an adjoining 136 acres of land was bought, at a cost of £725, thereby raising the area to 236 acres. The result of thirty years' farming, starting with a capital of £25 5s., has been the acquiring of 236 acres of land, the possession of implements costing £1,400, the erection of a residence at about £1,000, and farm buildings representing £700, which, with live stock, crops, and improvements, brings the total moneys invested up to near £6,000. Is it not apparent that the choice made on Lucknow thirty years ago was a wise one? Drainage is not necessary on the light red hill soils, but where clay prevails it will have to be done, and on the white clay bottoms open ditches have improved wet spots. There is a dam in the horse-paddock, and another in a more distant part of the farm Rain-water is conserved for household use in a large underground cistern, and pumped to a supply tank, so that it is laid on to the house. In the farm-yard there is a large underground tank for the live-stock. The character of the fencing is, from a practical standpoint, good in that instead of burning off the timber it has been drawn to a neat chock-and-log fence until required for fuel. In a cold climate much wood is used for household purposes, besides the demand of the steam-engine. The exterior and roadside fences are being replaced with one of seven wires and no top rail, to be ultimately planted with whitethorn. Leading to the homestead are many fences of whitethorn and African buckthorn, clipped twice a year, and kept exceedingly neat, giving an appearance like unto an English farm. Gates have wholly replaced slip-rails, and posts and rails of unusual strength divided the three yards of the homestead. There are nine paddocks, varying from 6 to 50 acres in extent. The residence contains ten rooms, and is built of bricks made on the spot, at a cost of 30s. per 1,000, and is situated in a small enclosure, portioned off into a flower and kitchen garden. The design of the house was made by Mr. Worboys, who studied having every convenience, water being laid on and every room built with a fire-place. The farm steading comprises numerous detached buildings, standing in a quadrangle,

with three large well-fenced yards, and typical of what a homestead should be. The wheat-store or granary is of stone, with iron roof, 45 ft. x 30 ft.; in it the wheat-dressing implements are placed, a bacon smoke-chamber and sleeping-rooms for two men. The large barn is 66 ft. x 35 ft., built of wood with a thatched roof, recently replaced by Mr. Worboys' own hands. To have covered it with iron would have cost £60, whereas £6 represented the outlay for rethatching. An older thatched building is the stable, and after twenty years' service its roof awaits recovering. Of course there is danger from fire and sparks from the steam-engine, but greater care is therefore exercised. The implements are stored under a large iron shed, but it cannot accommodate all the extensive collection. In a wing is placed the blacksmith's shop and tools, in the use of which Mr. Worboys and his sons are adepts. The milking-shed contains six bails, a continuous galvanised-iron trough for feeding at the head, and a yard where litter is trodden into farm-yard manure. The wheat-sheaves are carted direct from the field to the thrashing machine, which is so placed that the cavings are delivered into the barn for use as feed, &c. The straw is stacked to be used for litter and made into manure, the yield being about 15 cwt. per acre, worth 1s. 6d. per cwt.

The implements are an extensive collection, and comprise the 8-horse power finishing thrashing set (Hornsby, Marshall's straw elevator); two 1-furrow, two 2-furrow, one 3-furrow, and one 6-furrow ploughs, the latter by Hudson, proving a useful tool for rapid light work; disc harrow (Howard), the fore carriage of which is much approved; several sets of iron harrows; heavy cultivator (Ball); horse-hoe (Carson and Toone); Farmer's Friend wheat-drill, of Canadian make; Dobie's broadcast machine, to fix on a cart; 9-foot iron roller; horse-rake (Ashby); corn-sheller; two winnowers; rotatory corn-screen (Hornsby); corn-cracker (Hunt); chaff-cutter, for green stuff (Bentall); corn-sheller; trolly; two drays; spring-cart and buggy; three string-binders (Wood); large steam chaff-cutter and bagger, by Melhuish, of Springhill, and fitted with patent bagging plungers, which pack the chaff tight and do not clog; also saw-bench for cutting firewood. It is estimated that £1,400 would not cover the cost of the above. This collection is far beyond that usually deemed necessary for a 236-acre farm, but Mr. Worboys has made the more expensive outlays to earn their cost by working for hire, besides which the use of improved tools has lightened to a very great extent the laborious work of the farm.

A three-course rotation has been adopted, consisting of wheat, hay, and potatoes, or roots, or a fallow the third year. When the land is allowed to rest, a luxuriant growth of white clover quickly springs up, and by its nitrogen-gathering power restores fertility. Weeds in this elevated district are not so troublesome as where an earlier spring prevails; the crops, as well as the fences and headlands, were kept clean, and thorough preparation of a seed-bed is aimed at before sowing. The ploughing is got over early in the winter, and the first weeds of spring are worked out by cross-cultivation with a 6-furrow implement, of Hudson's make, having mould-boards without sides or slides, and giving a satisfactory pulverising result. Wheat for grain is put in by the horse-drill during April and May, whilst oats or wheat for hay are broadcasted by the machine. The winter growth of wheat induces plentiful tillering; in fact, one paddock, being too proud this season, was eaten close down by pigs, and rust is avoided by early maturity, although later crops are subject to it. The grain and hay are cut by string-binders, the former being stooked in shooks of ten for a fortnight, so as to mellow, and they are carried direct to the steam

thrasher. The cavings are stored in the barn for feed at home, and the straw is stacked outside and thatched. The grain is chiefly sold to the co-operative mill at Millthorpe, of which Mr. Worboys is a director, and he looks with pride upon the continucus good dividends (20 per cent.) it has paid. The market is carefully watched, and the grain is stored in the large granary, it being of very great advantage to a farmer to hold for a favourable turn, rather than rush a crop upon an adverse market.

The cropping this year is as follows:—Wheat, 52 acres; wheaten hay, 65 acres; oats, for grain, 12 acres; potatoes, 25 acres; peas, 4 acres; experimental wheats, 9 acres; turnips, 3 acres—total, 161 acres, cultivated. Pasture and fallow, 51 acres; waste ridge and stony ground, 10 acres; orchards and homestead, 5 acres. Total, 236 acres. The principal wheats grown are Talavera, Purple Straw, Blount's, and Lambrigg. No less than 9 acres were cropped with experimental wheats, 180 varieties being grown side by side, and affording an object-lesson of unusual interest. Especial care was taken in sowing, in keeping the drills clean, and the greatest accuracy will be necessary in harvesting, tying the yields up separately, and in weighing the results. The 180 varieties under trial were all sown in May, on a gently-sloping, friable, red, basaltic soil. The seed was drilled, and the plots extended according to the supply of seed, which varied from 1 bushel down to 2 oz. In order to subject cross-fertilised wheats to rust, they were planted late, and in rows alternating with rows of Steinwedel, which is sure to get rust, and, therefore, would subject the new wheats produced by Dr. Cobb to contamination. If the test is safely passed, then the wheat may be classed as rust-resistant, but the miller's value of the berry may yet indicate an unsuitable sort to grow on a large scale. Each variety possessed its own type of flag, height of growth, and luxuriance. Some were earlier than others, and all tillered more or less. Length of straw is no criterion of the quality or yield of grain, and the shortness of the straw of crossbred wheats was noticeable, whilst they excelled in length of ear and number of berries, the energy of the plant appearing to spend itself in grain. The use of the Sugar Company's No. 3 fertiliser greatly increased the yield last year, and now sulphate of ammonia is being tried. It would be wise for every farmer to conduct similar experiments, may be on a smaller scale, and with all classes of the plants cultivated, in order that something may be learnt, and whilst change of seed from a colder to a warmer clime is a cardinal feature of good farming, the successful experimentalist may look forward to opening up new lines of business in selected seed. Last year (1892) 34 acres of wheat gave 850 bushels, equal to 25 bushels per acre, selling at 3s. 3d. per bushel. This year 52 acres have been planted for grain. The most nutritious hay is made from wheat (bearded wheat with its solid stem makes the best). Last year 36 acres yielded 59 tons, which sold at £3 10s. per ton in the railway truck. This year 65 acres have been sown for hay. The cost of chaffing, bags, and delivery amounts to £1 7s. 6d. per ton, which, deducted from £3 10s., the selling price, leaves a profit of £2 2s. 6d. per ton. Oaten hay sells at the same price, and 20 acres gave 40 tons. This year 12 acres of oats are for grain.

Potatoes do well, and last year 15 acres yielded 60 tons, which sold at an average of £3 5s. on the truck. "Brownell's Beauty" is preferred, and "Sir Hercules" highly approved. The sets are dropped in one of the furrows after the three-furrow implement, then harrowed over, kept clean during growth, and are allowed to harden in the ground, the danger of frost being watched. They are dug by hand at a cost of from 6d. to 9d. per bag, the chief market being westward, and for seed in districts such as Molong, where

potatoes are early, and seed cannot be kept. Field peas last year sold at 4s. per bushel, and 4 acres gave 80 bushels, but they are chiefly used at home. This year 4 acres were being grown. One acre of white turnips last year gave 6 tons, which sold at £2 per ton. This year 3 acres have been put in, but the sale is limited.

The important question of making manure receives some attention. The large yard of the homestead was an extended dungheap, lavishly littered with straw, the treading being by horses having the run of it. The milking-yard and pig-pens were also littered with straw, the whole of that from the thrashed wheat having to be converted.. The open-yard system is not to be commended as perfect, for much of the valuable ingredients is lost in the drainage of the rainwater, but the return to the soil of a portion of its annual yield is to be noted, and if the natural clover growth on the fallows were extended over a year, and sheep kept to feed it off, doubtless no small benefit would accrue.

Fodder is conserved as wheaten and oaten hay, pasture hay is not made, nor is ensilage attempted. Great economy is effected by using for feed chaff and cavings from the wheat threshing.

No system of laying down grasses is pursued, save the spontaneous growth of white clover on the red soils during the rest year of fallow; this is of itself a valuable feature, but on soils which do not encourage its natural growth some grasses might be sown.

The livestock comprise the following:—Sixteen horses, 12 cattle, 5 swine, and 100 head of poultry. The horses numbered 10 farm, 1 saddle, 2 buggy, and 3 cart foals; in all, 16. The heavy draught horses were of an active farm type in excellent condition, particularly kindly and free to handle. Seven milk cows are kept, and a sale is made of surplus butter amounting to 10 lb. per week. The morning's milk alone is taken, the calves running with their mothers during the day. The rations given are green barley chaff, cavings, and a general pick-up. The dairy is in a room off the residence. Sheep are bought at Christmas and sold before winter to consume the autumn growth on the stubbles and clover leas, and crossbreds are preferred, but at the time of my visit, there were no sheep on the farm, although from 50 to 100 are kept in the proper season. At this period of the year the pig stock should number 20, but the usual purchases had not been made, so only 5 were on the farm being fattened. £60 is generally realized for bacon sold, and a large quantity is consumed at home. The feed is skim-milk and peas. Poultry return for eggs, and table fowls, about £15 per annum, 100 head of mixed birds being kept, including some ducks, and the fowls pick up their living by fossicking amongst the stacks, cavings, and straw. A neatly kept flower garden and a kitchen garden of equal extent immediately by the residence sufficed for the wants of the household, all classes of vegetables growing well. The orchards, old and new, covered about 2 acres, the natural growth of clover flourished in both, but an open space was chipped around the stems. Spraying and pruning were evidently not pursued, although needed.

Bookkeeping was up to a certain extent carefully attended to, a ledger being kept, but a perfect balance sheet was not prepared. The records of sales for eight years past were interesting, and figured out a return of £4 16s. 3d. per acre cultivated, averaging 114, whilst the expenses came to £1 16s. 3d., so that a clear profit of £3 per acre was arrived at. The total sales for last year was £606. The labour of the farm is done by Mr. Worboys, his son, and one man, extra hands are hired for chaff-cutting, threshing, and extra work, the wage averaging 4s. per day. Permanent farm

hands get from 15s. to £1 per week and their board. In figuring out the cost of keep of a farm horse, including farriery, the sum of 1s. per week is regarded as covering all expenses.

The subsidiary aids comprise cöoperative family labour, sales of seed, wheat, and potatoes, bacon, butter, eggs, poultry, home repairs, and farriery.

Amongst the points of interest, various especial features have been noticed such as the storage of dead timber in fences, white thorn hedges, the fallow rest with growth of clover, the use of chaff and cavings for food, the extensive collection of machinery, and the most interesting experiments in wheat culture. On certain portions of the farm there are basalt ridges with boulders extending down the sides. During the past thirty years, a large area has been cleared of these obstacles to ploughing, and at the time of my visit more of the ridge land was being brought under cultivation. The removal of these big stones entailed heavy work. Several acres of wet clay bottom were also being drained and cleared preparatory to ploughing, so that after this year there will be a substantial addition to the arable land. One hundred golden wattles have been planted; the name of the farm indicating how that they once throve on the land.

The system of management, with a view to profit, has been to do the farm work well, and to be early with it. Neatness prevails, fences are good, weeds few, cultivation thorough, superior seeds are sown, crops are harvested by the best machinery, and markets are closely watched. This vigilance and ready resource makes farming successful whilst the true lines of family cöoperation keep down the labour bill, and utilise many of the smaller sources of profit. The farmer has need to keep ahead of the times, and when markets do not serve, others have to be opened up. The experiments conducted by Mr. Worboys in wheat will, without doubt, lead to business in choice seed wheat, for it is necessary that a change of seed be made from a colder to a warmer climate. The wheat farmer has to compete against the world, and he who can sow a superior seed producing large heads with little straw, and a berry that millers will buy, has an advantage over the less progressive farmer. The fertility of a farm has also to be sustained by improved methods, particularly in keeping up the nitrogen resources. This the natural growth of clover effects on Mr. Worboy's basaltic soils, but the poorer clays need farm-yard manure, whilst the purchase of artificial manures has been shown on this farm to leave a profit. More attention to the making of farm-yard manure is generally necessary, particularly in protection against rain whilst the ploughing in of green crops adds to the store of decomposing vegetable matter in the soil.

Alick Frederick Warden, Sunny Vale, Milton.

South Coast District.—Place, No. 3; points, 88·22 per cent.; arable, 24¾ acres; pasture, 268 acres; homestead, 4¼ acres; total, 297 acres.

[5 November, 1893.]

Mr. Warden is his own landlord, being a life tenant under his father's will, in this and other farms, which will have eventually to pass to his children. Under this proviso there is no great inducement to invest all profits in the farm, but a large sum was spent on entry, and each year many improvements are made, so that this farm may be taken to represent the very best form of tenancy.

The main coastal mountain range is distant 9 miles from the ocean, and the farm lies somewhat farther from it than the sea. The intervening

country is undulating throughout, and very broken as it approaches the mountains. Granite predominates near the ranges, and sandstone of the carboniferous age near the coast. The original vegetation was dense forest and luxuriant undergrowth, and the clearing must have been heavy work, judging from the ringbarked timber that remains in several of the paddocks. The soil is a deep brown-red, rich in vegetable matter, and lies to a depth of 3 feet on the slopes and much more so on the flats. The debris is either from a granite or basalt, boulders of which strew the soil, and weather away rapidly when exposed to damp, renewing with elements of rich fertility the land.

The farm occupies a choice site, chiefly a gentle valley with adjacent slopes and one steepish ridge forming the watershed of a small creek which rises on the estate. The westerly winds make themselves felt. A dense thicket of wattles shows how nature designs a wind break, and Mr. Warden has planted rows of trees to shelter the farm-yard. The pasture is luxuriant throughout, and leads to dairying being the main feature of the farming. Scarcity of rain, however, pinches the pasture, rendering some provision of fodder a necessity when a large dairy herd is kept. The market for the butter is Sydney, *via* Ulladulla, the shipping port, distant 6 miles, and with two boats weekly to the metropolis. The farm is 3 miles away from Milton, the local centre of population, and on either side to the north and south the country is virgin forest, whilst the high ranges at the back effectually cut off the table-land. The nearest mining centre is Nelligen, 40 miles distant. This isolation compels Sydney being made the one market.

There are no wet spots on the farm, and the porosity of the soil renders underground drainage unnecessary. Water conservation might take the form of a dam that could be constructed at a spot to command many acres with waters of irrigation. The creek is thrown back at intervals with dams which afford crossing roads for cattle to and from the milking yards, whose many feet as it is cut deep tracks into the pastures. There are also water-holes on some of the paddocks. Rain-water is conserved in cement and other tanks to the extent of 20,000 gallons, a large supply of pure water being thereby rendered available for the dairy.

The fences throughout are in good order, and kept free from weeds, Mr. Warden having practically renewed them on his entry eight years ago. The external are of three-rail and the divisional of two-rail; barbed wire is only used across the water-courses. The paddocks, twenty in number, vary in size from 3 to 50 acres, the grass ones being browsed in rotation by the dairy cattle. There is a line of well-kept metalled road ¾ mile in length, extending from the homestead to the public road, and all its gates are of an excellent pattern, whilst throughout the paddocks there are slip-rails.

The homestead occupies a site nearly central to the farm, and the buildings are placed in a large rectangular paddock, with the residence and garden at one short end. The farm buildings extend along one long side, and away from them is placed the coach-house and stable, with a good cottage for the dairyman, and another, at a little distance, for a farm hand. There is also another farm cottage on the estate. The residence is a new, compact, and substantial building of stone, containing four rooms, with detached kitchen and other rooms, of brick. In front of it extends a large flower and vegetable garden, kept in excellent order, and most productive. The farm buildings consist of four groups, viz., the dairy, milking yards, piggeries, and barn, each possessing points of interest, and all very substantially built. The milking bails are six in number, under a good shingle roof, the upper part being used as a granary. The floor of the bails is paved with tar concrete,

and at the head of each is a door, through which the cow, when milked, passes into a yard, and is immediately followed by the next one awaiting milking. This simple addition does away with the confusion between incoming and out-going cattle that otherwise prevails, and should be generally introduced. The yards are paved with stone, and kept particularly clean, all manure being saved for the ploughed land. The dairy is a spacious one, originally constructed for the old hand system of butter-making, but eight years ago Messrs. Waugh and Josephson were entrusted with putting in a Laval separator and steam machinery which have worked from the first without any hitch whatever, and have given the utmost satisfaction. Mr. Warden is particular as to neatness, and the machinery is kept scrupulously clean, small repairs being attended to at once by himself. The engine—a four horse-power "Soho," by Tangye—drives also the food-preparing machinery, consisting of a corn-sheller, corn-cracker, chaff-cutter, circular-saw bench for cutting firewood, and a pump, elevating water to a tank, commanding the residence to which it is laid on, as well as to the garden and fowl-yard. The piggery is kept exceptionally clean, the floors being of cement, which possesses the disadvantage of being cold to lie on. The building it of weatherboard, with iron roof, neatly finished in every respect, having a central passage giving access to four styes on either side, each with a yard 6 feet by 8 feet, and a cast-iron feeding trough, cemented in. The concrete floors drain to the paddock, where there should be a tank to receive the liquid, which now soaks away to waste. The original piggery of slabs and battened floor is used as a calf-pen, and under it pigs in a large yard take shelter. There is a good-sized pig paddock adjoining, and a large copper is provided for cooking pig food. The barn, 60 feet by 25 feet, is of weatherboard, on stone foundation, with iron roof, and leans-to, affording thirteen roofed-in pens, to accommodate as many cattle in the winter. There is also a separate tool-house and smithy, a long range of poultry houses and yards, as well as an implement shed. The expenditure for residence and buildings could not be less than £1,200 in equal amounts, and was incurred on entry eight years ago. The homestead, for design, substantial nature, and attention to detail, may be regarded as a model one.

The implements comprise—3 one-furrow ploughs, disc harrow, 3 wood harrows, 2 wood rollers, Howard's hay-rake, "Albion" mower, "Planet, junr." hand garden cultivator (complete), 2 carts, and 2 drays, in value about £160. The dairy plant consists of Lawrence cooler, Laval's 90-gallon separator, 100-lb. Kiama churn, butter-worker by Cockerill, of Gerringong, "Avery" platform scales, can steaming plant, and a four horse-power "Soho" engine and vertical boiler by Tangye, "Hunter River" corn-sheller, corn-cracker by Richmond and Chandler, Bentall's chaff-cutter, and saw-bench, representing an outlay of close on £280, making a total investment of £440 for the machinery and implements enumerated.

The cropping of the farm was as follows:—Maize with pumpkins, $7\frac{1}{2}$ acres; pumpkins, $1\frac{1}{2}$ acres; planter's friend, 7 acres; oaten hay, 7 acres; experimental plots of Cape barley, $\frac{1}{3}$ acre; wheat, $\frac{1}{3}$ acre; rye, $\frac{1}{3}$ acre; lucerne, $\frac{1}{4}$ acre; in all $24\frac{3}{4}$ acres under cultivation. The pasture land was 268 acres, and homestead $4\frac{1}{4}$ acres, in all 297 acres. The food requirements of the dairy cattle necessitate about 25 acres being cultivated, and each year a fresh portion of pasture is broken up, and the previous 25 acres laid down with rye grass and clover. The winter feed of the herd is green barley and oats sown in February, in spring they graze wholly on the pastures; and in summer have in addition green maize and kaffir corn, whilst in autumn planter's friend and sorghum is relied on. The pasture lea is ploughed up

with bullocks, and, if the ground is soft, by horses; the disc harrow is found most useful in cutting across the furrow slices, and maize is sown either broadcast for green fodder, or in a furrow for corn, in which case horse and hand hoeing is carefully attended to; husking takes place in the barn, and the stalks are burnt or rotted for manure. The yield on an average may be taken at 55 bushels per acre.

The mainstay of the farm is pasture, and to the very top of the ridge, some 300 feet in elevation, rye grass and clover grow luxuriantly. Every care is taken to keep the pastures entirely free from tussocks of coarse grass, which are hoed out and burnt. The paddocks are numerous and small in area, so that the cattle are shifted every day or so. The creek waters most of them, but in some dams have been made.

Fodder is requisite for carrying a large dairy herd over the summer, wherefore oaten hay is made, and about 14 acres of pasture are mown for rye-grass hay, some of which is thrashed for grass seed, and 2 bushels per acre are sown with oats on the renovated pasture.

About 2 acres have been laid down under experimental crops—wheat, $\frac{1}{2}$ acre; rye, $\frac{1}{3}$ acre; Cape barley, $\frac{1}{3}$ acre; and lucerne $\frac{1}{4}$ acre. To the Steinweld and Leak's rustproof wheats, blood manure has been applied with marked effect. It is not to be expected that wheats can escape entirely rust, but early sowing and a good start with manure may force the plant along so that it cut a luxuriant crop for green feeding. The Cape barley is handy for poultry feeding, and for the pigs. Mammoth rye was a most vigorous crop, and lucerne had taken so firm a hold as will lead to its more extended growth. The pumpkins and a small quantity of Swede turnips come in for general use.

Manure is not generally made a feature on a dairy farm, but Mr. Warden keeps the stables, milking yards and piggeries particularly clean, and the gathered manure is heaped for use in the vegetable garden and ploughed areas. If the drainage from the piggeries was collected and used to moisten the heap more perfect farm-yard dung would be made.

The live stock number 19 horses, 189 cattle, 50 sheep, 67 swine, and 150 head of poultry, which may be valued at £1,327. The horses were a good type, there being 3 plough-horses, 6 saddle-horses, and 10 breeding-mares, but the South Coast district is not a satisfactory market, save for a good driving-horse. Working bullocks are needed on this heavy land. The milking-herd is of the representative Illawarra type, Durham predominating, with crosses of Ayrshire and Jersey, the whole forming an excellent collection of milkers. There were 75 cows in milk, 30 dry, 20 springers, 50 yearlings and calves, 2 bulls, in all 177, and 12 working-bullocks; total, 189. The pasture is good, but the cows were somewhat thin, showing that all they can eat is needed for the milk supply, consequently a feeding-ration would be beneficial. This drain on the system is observable in most dairy districts, save where the pasture is exceptionally rich, and there condition and milk yield go together. The average age of the cows was moderate, but at Milton it would not be economical to cull a milker until she ceased to milk at a profit, seeing what little value cattle fetch to-day, stores selling at 30s., and fats at £6. The bulls in use were pure Durham of high dairy quality, and one of a first cross between the Durham and Ayrshire, also of the best milking strain. The natural goodness of the herbage on the ridge kept the springers and dry cows in prime condition. The herd, as a whole, is worthy of high commendation.

A few crossbred sheep were kept, and looked remarkably well, coming from the Braidwood district, and yielding excellent mutton for home use,

and a cross between the Lincoln and Southdown lends itself to this purpose. The character of the swine was exceedingly good, the boar and breeding sows being of New Zealand strain, coming from Rowe, of Christchurch. The stock comprised 1 boar, 6 sows, 15 fat pigs ready for market, and 45 young pigs, in all 67. There were 150 head of mixed poultry carefully attended to, in good houses and yards. A 100-egg incubator has given fair satisfaction.

The kitchen and fruit garden with several trees were carefully tended, and grew a great variety of vegetables for household use.

A farm-labour book was kept, together with a full record of dairy-herd data, butter returns, as well as entries of purchases and sales. The labour bill may be taken as £271 per annum, the dairyman being paid 25s. per week and a house; his wife acts as butter-maker and milker, getting 12s. per week, and the son and daughter 3s. each. The plough-hands received 25s. and 24s. with house, the plough-boy 14s., and a State boy, boarded out by the Government, also takes the milking, so that there are six milkers to deal with the 75 milkers.

The subsidiary aids are pig-breeding, bacon-curing, cheese-making, poultry-raising, and the sale of eggs. Some pigs are killed yearly for home use and the bacon cured, the surplus being sold. Butter is the main product of the farm. It was carefully made, and of a very high quality, invariably fetching a good price in Sydney.

The points of interest may be taken as a well-designed homestead, residence, and farm buildings throughout, the making of cheese, engine power applied to many purposes, an incubator, cooked pigs' food, and methodical renovation of the pastures, together with a superior milking-herd.

The general management, with a view to profit, hinges upon dairying, the climate and pastures being well suited, whilst the restricted area of the coastal district renders it the only possible line of farming. In years gone by Ulladulla butter, made by the hand method, had an excellent name, and steam communication gave cheap transit to market. The separator, moreover, was taken up by individual farmers at once on its introduction, and to-day there is no co-operative butter factory at Milton, because the leading farmers all have separators. Competition in the butter trade, however, increases. The districts in connection with the metropolis by rail are hurrying cream forward to be churned in the city, and they can also forestall the sale-days of sea-borne butter, wherefore it behoves that the utmost pains be taken that the latter be first-class. It must necessarily be a great disadvantage to the trade that dozens of different makes and brands come forward from each seaport, whereas one uniform packing, such as the factory for the district would produce, would command the market; and the time may come when existing separator plants will become creameries and forward each day's cream to the butter factory at the port. Mr. Warden is one of the large farmers of the Ulladulla district, and gets full price for his product; but he complains of the frequent samplings each tub undergoes when on sale at the agents, this being the outcome of so very many small shipments instead of one brand of uniform quality being sent forward. The skim-milk is utilised in rearing calves and fattening a really good type of pig. Some very promising cheese has been made from directions given in the *Agricultural Gazette*. The dairy herd represents eight years' skill and forethought. The rotation of grazing protects the pastures from being eaten bare, and the system of cropping supplements them with hay and green food. They are also methodically renewed every year. Poultry adds £100 per annum to the turnover, and the other returns amount to £1,000,

whilst the money invested in improvements, plant, and live stock cannot be less than £3,000. It is interesting to note that the average of butter per cow per annum was 212 lb., selling at £10 12s. The farm stands forth as excellently managed and representative of the highest type of tenure, giving entire freedom of management with lifelong possession, and a sense of security in the investment of profits.

W. H. Wilford, Loch Leven, Milton.

South Coast District.—Place, No. 2; points, 90·31 per cent.; arable, 34 acres; pasture, 127½ acres; swamp, 38 acres; homestead, 3 acres; orchard, ½ acre; total, 203 acres.

(8 November, 1893.)

Loch Leven is 203 acres in extent, and occupies a sheltered position from the north-east and westerly winds. It is distant 2 miles from Milton, and 2 miles from the port of Ulladulla. A ridge of low hills separates it from the ocean, and a saltwater creek, navigable to small craft, bounds the property on the south-western side. From the dwelling-house a very pretty view is got of its waters, which also afford much pleasure in boating, fishing, and shooting. Thirty years ago the land, when in a partially-cleared and unimproved condition, was so uninviting that the highest bid at auction was £900. It was withdrawn then, and since sold and let to a tenant for a short period before it attracted Mr. Wilford's attention. Happening to be on a visit, he saw the capabilities of the land, and secured 137 acres in 1870 for £1,300, and since then 66 acres have been added at a cost of £800 so that 203 acres cost £2,100, *e.g.*, a trifle more than £10 per acre.

Mr. Wilford comes of a family of Yorkshire farmers, and, although not at first when in the Colony engaging in agriculture, commenced the hereditary profession by renting a farm at Kiama, next at Jervis Bay, and finally at Milton. The low-lying lands by the saltwater creek were a swamp and lagoon, so that Mr. Wilford's first procedure was to construct flood-gates, and shut off the tide, whereby the lagoon was made sweet water. Contour ditches were run at the foot of the slopes to cut off the hill soakage, and amidst much dirt, and with great labour, surface-drains were made through the marsh, leaving the present lagoon of 3 acres, which is frequented by wild fowl at times in great numbers. The black mud of its bed has, however, been utilised for dressing pastures with the greatest effect, whilst heaps of shells found elsewhere on the property have been largely availed of as an additional fertiliser. The farm in 1870 was covered with tussocks a yard high of coarse grass, whilst weeds overran the land. Mr. Wilford, unaided, burnt these off, felled the dead rung-timber which cumbered the ground like a forest, burnt it off, carefully spread the ashes, sowed rye-grass, and laid the foundation of the splendid pasture of to-day. The farm is now wholly cleared and fenced off into small paddocks watered by ever-running streams in every undulation. The land lies in horse-shoe form around, and gently sloping down to the lagoon, and two-thirds of the estate can be viewed from the drawing-room window. The conditions of the district render dairying the chief and most profitable pursuit, and butter from Loch Leven dairy has had the best demand in Sydney. Such excellent pasture is worthy of high-class stock, and Mr. Wilford's herd is unsurpassed in the Colony.

The geological features are that a volcanic rock is overlaid by a deep, rich brown soil of great fertility. The iron of the component minerals of the rock accounts for the rich colour, and it would be interesting to learn

by analysis whether the felspar is of the potash group. Many boulders found throughout the soil weather rapidly, and renew its fertility. Here and there some clay is met, and in one part sandstone outcrops, yielding a poor soil.

Drainage on the slopes is not requisite, and the reclamation of the marsh deserves the highest credit. Streams that never fail water every paddock, whilst underground tanks, holding 22,000 gallons of rain-water, provide an ample supply for the homestead and dairy.

The fences throughout are three-rail with twenty-three gates on the property, all made by Mr. Wilford save one, and there are some slip-rails. The fences were in good order. There are twenty-four paddocks varying from 3 to 20 acres in extent, which enables the pasture to be grazied in rotation. A main public road bisects the property, affording ready access to most of the fields.

The residence consists of a six-room stone house, occupying a commanding site, with a beautifully kept garden in front, showing what the soil can grow. There are offices and other rooms in addition, and adjacent is the large dairy building, with butter-making conducted on the old-fashioned "set" system, the churn being worked by an American one-horse tread gear, once not uncommon in the South Coast district, but now rather rare. On the other side of the quadrangle are the coach-house and stables, an enclosed shed. and range of piggeries. Hand-tools are kept in their proper places, and there is a portable forge with various tools for doing repairs, shoeing, and general carpentry at home, Mr. Wilford being more than an amateur. A hay-shed is erected in a paddock containing an emergency supply of fodder. The dairy is of stone, and the other buildings of slab and weatherboard, all being serviceable for their purposes. The piggeries have runs leading to the slaughter-yard, as well as a paddock with a small area of the densely overgrown original brush, showing what difficulties encountered the pioneer in clearing the land. Poultry form somewhat of a feature, and are provided with several yards and houses, and the bees are kept in the garden. The milking bails and yards are of the usual type, and two have recently been commenced in response to the invitation of an officer of the Department of Agriculture for a model design, on a plan introduced by Mr. Wilford when at Jervis Bay. By a cord, the milker, without moving an inch, first releases a door at the head which flies open, and then the bail falls back, so that the cow is free to walk out and a successor immediately comes to the bail without confusion. Mr. Wilford also possesses drawings of a milking-machine, designed by his brother, the late Mr. Charles Wilford, some twenty years ago, which show all the essential features of the most recent plans to milk by means of a vacuum.

The following is the list of implements:—One one-furrow iron and two one-furrow wood beam ploughs, two wooden harrows, "Albion" mower, "Howard's" hayrake, "The Reversible" scuffle, corn-sheller, corn-cracker by Richmond and Chandler, American horse-tread, two spring-carts, dray, slide, and buggy, "Adkins" 100-egg incubator, tools and forge, platform scales, two large churns and appliances for a hand-dairy.

The farm is cultivated as follows:—Maize, 14 acres; sorghum and Planters' Friend, 20 acres; in all 34 acres—arable, 127½ acres; rye-grass pasture, 3½ acres; homestead, orchard and paddocks, and swamp, 38 acres; total, 203 acres. Maize sown broadcast for green food or in the furrow is well hoed, husked in the barn, and the stalks are rotted in heaps for application to poor land. Some very large yields of maize have been secured, and in the competition for 1892 for "the best prize acre of maize" Mr. Wilford ranked

only four points behind the winner, who grew over 100 bushels to the acre. "Hogan's" corn is sown, and none is sold, all being required for the live stock and pigs. Sorghum sown broadcast is relied on for green fodder during late summer, the cows being timed to be in full milk for the more profitable winter season, so that during summer the milkers are comparatively few. Planters' Friend, if sown broadcast, is found to be the cheapest means of stifling weeds, and has been so used for many years past to cleanse the pasture paddocks. They are also renovated whenever signs of getting poor are observed by the application of lagoon-mud and shells. During the past three years 38 acres of lea have been ploughed up for maize and sorghum, to be resown with rye grass. When Planters' Friend is sown to stifle weeds, the lea is ploughed in October, and sown at the rate of 30 lb. of seed per acre broadcast. In May it is cut, the heads being housed to dry, and the stalks taken on a slide to the cattle. The threshing is by flail, and last year 3 tons of seed were got from 5 acres, being at the rate of 22 bushels of 60 lb. to the acre. The selling price is 3d. per lb., or a return of £18 per acre. Rye-grass is also harvested for seed, and this season two paddocks, aggregating 13 acres, have been laid up, to be cut about the middle of November, when the heads are full ripe. A light hand-rake gathers the heads into heaps, and the cut grass is lifted on to one sheet and covered by another. It is then drawn on a slide to the threshing-sheet, which is set in a paddock, and threshed by the flail. After a rough cleaning the seed is dried in a loft, and put through a winnower, the foreign seeds easily shifting out. Sales are readily effected at from 10s. to 12s. per bushel of 20 lb., one acre yielding 30 bushels, or £15 worth of seed. A small cultivation plot on the reclaimed flat gave evidence of the suitability of the soil for the growth of potatoes, sugar beet, and mangold, which were for home use. Pumpkins are planted throughout the corn, and when sown by themselves pig-manure is buried beneath the seeds, which make, in consequence, a vigorous start. A few pumpkins are sold. Two acres of lucerne, sown as an experiment during the last week in August, have made a wonderful growth. A barn 20 feet by 18 feet is kept stored with oaten and rye-grass hay as a standby, and although the seasons seldom cause anxiety where such grand pasture grows, Mr. Wilford prefers to run no risks.

The system of manuring with lagoon-mud and sea-shells has been noticed. All yard-droppings are gathered and rotted in a heap for general application. In order to prevent weed seeds being introduced through the sheep-dung manure into the garden, it is used as a liquid. Maize-stalks are not burnt. Last year, as an experiment, small plots were manured with blood and bones.

Fodder is conserved as hay, and pastures are systematically laid down. It would be difficult to meet with cleaner or more luxuriant rye-grass pastures. The land, after maize, sorghum, or planter, is sown broadcast with home-saved rye-grass seed, mixed with the clover that has been reaped with it, at the rate of 2 bushels per acre, and in a few weeks it becomes established pasture. There is a coarse water-grass, with sharp, serrated edges, which frequently serves to cut off the front teeth of grazing animals, known as "Cutty" or "Merramarang" grass, after a station so named. Mr. Wilford has observed that the ill effects only take place on animals with a change of mouth. The leaves, getting between the teeth, act as a saw, and soon cause the loss of several. He eradicates it successfully by constant mowings and ploughings in a dry season. The live stock number 8 horses, 164 cattle, 40 sheep, 52 swine, and 380 head of poultry. The horses number 8, and include 1 stallion, 2 plough-horses, and 5 saddle and buggy horses, 2 of the light

being breeding-mares. "Royalty" is a coaching stallion that has a reputation in the neighbourhood, and adds to the farm turn-over, having served thirty mares at £3 3s. this season. He is out of a Cleveland mare, who was by "Duke of Cleveland," an imported horse of that breed. His sire is "His Royal Highness," an imported Yorkshire trotter. In "Royalty" the Cleveland characteristics predominate, in colour a striking bay, with black points, 16½ hands high, with clean bones, powerful limbs, and great strength of back. Carriage-horses of this type will be equally useful for all farm purposes, and if the young stock possess style they will be certain to command good prices in the Sydney market. The cattle number 4 stud bulls, 31 stud cows; in all, 35 stud cattle; also, 49 milkers and 80 head of young stock; total, 164. Three of the stud bulls are Durhams and 1 Ayrshire; 25 of the cows Durhams and 6 Ayrshire. Mr. Wilford is justly proud of his dairy herd, the outcome of thirty-five years' experience and selection. It was started with Durhams of Low's Murrumbidgee strain, famous in 1858 for large frames and deep milking, and has been increased by using Durhams, which were the pick of the Kiama district. When at Kiama, the best Durham bulls that could be procured were used. In 1879 "Tacitus" dominated his herd, a famous bull by "Victoria's Theodore," whose sire was of Dr. Jenkins' Nepean Towers herd, and with a pedigree on the female side back to the original E. M. Cox's cattle of Mulgoa. Home-bred bulls of the "Tacitus" strain were used up to 1887, when Mr. Wilford determined to introduce for the sake of vigour an Ayrshire touch in the shape of "Scotchman," a pure-bred bull two generations removed from "Tahuna," the Ayrshire champion of New Zealand in 1879. "Scotchman" having impressed his features on the herd, recognised by leopard-like markings and a great milking record, has now given place to a Durham bull, "Duke," aged 9 years, from a pure Durham coast sire and dam, the parentage on the mother's side being pure "Major." "Duke's" father was of "Conqueror" strain, which is noted as possessing especial milking characteristics of the long-horn Durham or Bates family. In the herd to-day the stud cattle consist of the "Tacitus" cows and young stock that are half Ayrshire by "Scotchman," only first crosses having been kept. Heifers have been seldom sold, because the stocking of a son's herd has absorbed a large draft. The average price obtained for twenty-four "Tacitus" bulls during about seven years has been £19, and the "Scotchman" bulls realise £10 apiece. So well-known a herd has swept numerous prizes from local and metropolitan shows, the record of first prizes won by "Tacitus" cows since 1885 being fifty-four. The average number of cows in milk is thirty-seven, and the books show a return of nearly £14 16s. for butter per cow per annum. The cattle throughout are of a particularly level type, in first-class condition, Durham reds predominating, the Ayrshire cross with leopard markings being noticed at once, and the points of both are typical of milkers, with prominent veins and large udders. The Durhams are all that such famous cattle should be, and the Ayrshires are equally as good. With skill in the dairy and such good cattle it is no wonder that Loch Leven hand-made butter gets top factory price.

Swine are so closely associated with a dairy in the economy of using skim-milk that Mr. Wilford commenced in 1892 to found a pure strain of large Yorkshire pigs, obtaining from Rowe, of Christchurch, New Zealand, "Windsor Prince," a boar 21 months old, and "Countess of Glasgow," a sow aged 3 years. He now has four other sows and a young boar of another family, making seven in all. The Yorkshire have taken many prizes, and young boars sell at £4 4s. and sows at £2 2s. apiece. These pigs grow to a great size rapidly, a boar six months old, and sold at the time of my visit,

weighing 200 lb., and a half-bred sow 183 lb. at five months old. There are 4 Poland-Berkshire breeding-sows and 41 stores fattening, in all 52 pigs. A few cross-bred sheep are reared on the farm, being got by Southdown rams out of Lincoln ewes, and serve for home consumption. The flock numbers 40 sheep. Poultry are well cared for, numerous pure varieties being kept, including Houdan, Game, Orpingtons, Plymouth Rocks, Leghorns, also 80 ducks, including several wild ducks, hatched from eggs found near the lagoon, which large numbers frequent. An "Adkins" 100-egg incubator has given 80 per cent. results. Bees in gin-cases have dwindled from 50 to 7 hives, because of the depredations of the moth, but Langstroth frames are now about to be used. The vegetable garden is a picture of luxuriant culture, showing splendid results from choice seed. There is a small orchard and fruit garden where citrus and stone fruits,guavas, vines, and persimmons do well. It was found that oranges did not succeed, until by cementing a block of soil 4 feet in diameter, and then planting on it, so as to disperse the roots in a wide circle rather than let them go straight down. The fruit and vegetables are for home consumption.

Bookkeeping comprises a day and cash book, and data relating to herd, stud, and dairy products. The labour of the farm is done by the co-operation of three sons, and two "State" boys, who very readily take to farm-work and milking, and will in time become useful members of society, the State having taken charge of them as utterly poor, but not in any way tainted with crime.

The subsidiary aids are co-operative family labour, home-killed mutton and beef, about a beast a fortnight being used, and the surplus meat sold to neighbours, home-cured bacon, sales of horses, stud cattle, pure-bred swine, and poultry; also butter, eggs, and table-birds, as well as pasture, sorghum, imphie, and planter seeds; home repairs and carpentry.

The points of interest are the planting of a long line of thorn hedge as a wind-shelter, and numerous ornamental trees near the residence, including elms, poplars, pepper, and pines; the reclamation of a marsh; the planting and renovation of rye-grass pasture; the eradication of tussocks by hoeing, of weeds by Planters' Friend, and of "cutty" grass by mowing; a dairy herd of the highest character, and butter of prime quality; timing the cows to calve during winter; keeping a reserve of hay.

The general management, with a view to profit, may be summed up as good pasture, good stock, and good butter. The excellence of the land, its fertility, and the means taken to sustain it, is evidenced by the beautiful growth of rye-grass and clover. Fewer cattle are kept than the land will support, but Mr. Wilford likes to have a reserve of food. The fences are good, paddocks small, water never-failing, and roads convenient. The cattle are constantly changed from pasture to pasture, and that which looks either dirty or poor is renewed or manured. The cultivated area provides green food during the seasons when needed, and seeds are saved for sale at a profit. The dairy herd excels as milkers, pure strains are kept, and an Aryshire cross, proved years ago, to add vigour, has been repeated. The dairy work is well done, and top price for butter proves that the old system can hold its own against the factory. The original outlay of £2,100 may be regarded as having been supplemented by quite that amount of improvements, and the capital invested in plant and live stock cannot be less than £1,400, whilst the returns for 1892 amounted to £1,263. The annual value in butter, from each cow, came to £14 16s. What the auction value of this farm might be cannot be stated; possibly £40 per acre would be too low a figure.

J. H. Sommerlad, Spring Valley, near Tenterfield.

North Tableland District.—Place, No. 6; 83·26 per cent.; arable, 91 acres; pasture, 6 acres; rung, 450 acres; homestead, 1 acre; orchard, 4 acres; total, 552 acres.

(24 November, 1893.)

Spring Valley farm affords an example of a mixed farm in which dairying and a large orchard form leading features. Mr. Sommerlad was brought up to nursery gardening near Frankfort, in Germany. He arrived in the Colony in 1855, and went to a situation on a station in the neighbourhood of Tenterfield. It was incumbent on him to repay his passage-money, and in two years' time this was accomplished, with a surplus saved as well, although the wages were low, but many extras were earned by general handiness. In time he set up in Tenterfield as a fruit and vegetable grower, there being an excellent market by reason of the mining in the district. The 10 acres of the first occupation yielded sufficient money to enable him to purchase, in 1877, the 404 acres of the Spring Valley farm. There was, at that time, only £100 worth of improvements on the property, but an orchard was planted, and as years passed more and more land was fenced and cleared, drains were cut, boulders removed, and hollows filled up, until now 100 acres are under cultivation. The profits since 1877 have been invested in the farm, and in bringing up a large family, of whom ten are now living, two sons on the verge of manhood, and associated with the father in the work of the farm, having passed away. Family co-operative labour has been the secret of success. Some additional areas have of late years been acquired, 97 acres being taken up as a selection, and 14 acres purchased; whilst 37 acres have been selected since the farm was entered for competition.

Spring Valley is distant 4 miles from Tenterfield, and is about 2,800 feet above sea-level. Several public roads lead to or pass through the property. The lay of the land is a gentle slope towards Washbrook Creek, which is never dry. The property extends up to and over some low ridges of granite hills, precipitous and boulder-strewn, yet upon which nutritious grass grows, but where cultivation is entirely out of the question. The principal timber is peppermint, mostly ring-barked, and what is left only sparsely covers the ridges. High mountain ranges are distant some miles on every side. The chief winds are west and east, the latter generally bringing rain, which averages 34 inches per annum. The market for produce is somewhat limited, seeing that Queensland and barren country hem in Tenterfield, whilst the distance to the "Elbow" on the Clarence, to which the river is navigable, is 80 miles by a rough road, effectually cutting off the coast and sea shipment. When Deepwater and Fairfield were active mining centres, Tenterfield did a flourishing trade, and in fact the town has been built up out of mining.

The high elevation of the tableland renders the climate very bleak in winter, live stock suffering, and dairy cattle have to be hand-fed. For fruit-culture the locality is well suited. The country rock is granite, and the soil is rotten granite, more or less deep, and in some places a cold clay underlies. Where this occurs in the undulations a black soil of marsh origin is found.

The gentle slopes of the farm afford fair soil for cultivation, and a great deal of time has been spent in removing boulders by blasting, and either piling the debris in heaps or in filling up with it inequalities, and carting soil over so as to make a surface for cultivation. A large amount of

draining and trenching has been done preparatory to planting the orchard, as well as in the reclamation of wet ground. One open cut, 4 feet x 2 feet, extends 400 yards, furrow ditches have been made, and a mile of underground drains of stone and wood have rendered the orchard-ground good soil. The new orchard has, moreover, been trenched 2½ feet deep, and four years ago 300 trees were planted 25 feet x 25 feet apart.

There is no need for the conservation of water by reason of the regularity of the rainfall, small iron tanks being sufficient for the household; the creek is never dry, and a small dam suffices for the homestead paddock.

The enclosing fences are of one-rail, with two or three wires, and some of two-rail; the original fence is being renewed, otherwise they were in good order. There are ten gates to the six cultivation paddocks, and slip-rails to the pastures.

The homestead lies on a gentle slope overlooking the greater part of the farm, and consists of three adjoining slab cottages, facing the extensive flower-garden and orchards; and at the back is the quadrangle of the farmstead. Mr. Sommerlad removed the original cottage of four rooms from an unsuitable site to alongside the second cottage of five rooms, containing the kitchen, and with a lean-to, where are placed the fruit-evaporator and blacksmith's forge. A smaller cottage, in its own garden, is occupied by the daughters. The flowers and orchard give to the whole a pretty effect, and thorn-hedges have been planted for shelter. The farm steading occupies the other sides of the farmyard, and consists of distinct buildings of slabs with iron or shingle roofs. In it is comprised a barn, seven-stall stable and harness-room, three milking-bails, an open cartshed, a smaller barn, a meat and bacon curing shed, the dairy, an apple-room, and tool-house. The poultry-yards and piggeries are near by. The latter present a comfortable appearance, and consist of a low shed, with board floors, divided into three styes, two of the open yards being paved and thickly bedded with straw, which sops up the slush of the usual stye. The poultry-yards were clean, and the house subdivided. The somewhat unusual feature of a place for everything was noticeable—pegs for the harness as well as the hand-tools. The milking-yard was straw-littered, and therefore clean, no straw being sold, but all kept for manure. If the farmyard manure was made in a covered pit, with a cistern to catch the drainage, a better method would be instituted.

The implements comprise 3 one-furrow ploughs, a two-furrow, by Hornsby, with the original long mould-boards shortened, and is especially liked for use where boulders lie on the surface; a two-furrow orchard plough, made by Hill, of Tenterfield, after an American model, is highly prized for cleaning weeds in both orchard and field; an expanding iron horse-hoe, of Toowoomba make; a double mould-board plough, with potato-raising body, wood roller, iron harrows, Wood's mower, and Deering's string binder, which has given great satisfaction; horse-rake, horse-gear, Bentall's chaff-cutter, corn-sheller, and a 50-cow dairy plant for the "set" system, but not now used since the milk goes to the factory. Also honey-extractor, small cheese-plant, Avery platform scales, two drays, spring-cart, and buggy. Light repairs are done at home.

The farm is laid out as follows:—Arable land, 97 acres; natural pasture, 450 acres; homestead, 1 acre; orchard, 4 acres; total, 552 acres. On the cultivated area there are grown 45 acres of wheat, 24 acres of oats, 16 acres of maize, 6 acres of potatoes, and 6 acres of artificial pasture. There is no fixed rotation of crops followed; but after two years rye-grass a crop is taken of potatoes or wheat, followed by oats or maize. Frequently potatoes follow

wheat. The wheat, maize, and oats are sold, and the straw is stacked for litter. The cereal hay is sold as chaff, or used at home, and potatoes are sold. Cavings after thrashing are burnt, to destroy sorrel seeds, insect and fungoid disease. Wheat is taken after a two years' rye-grass lea, or maize, or potatoes. Ploughing starts in April; 1½ bushels of seed is broadcasted per acre, the varieties being "Sommerlad's Champion," raised on the farm, in type similar to "Talavera," and looked upon as the most satisfactory; "Californian," "Lambrigg," "Egyptian Bearded," and "Allora (Queensland) spring wheat." The average yield, over a term of years, may be taken at 16 bushels per acre; but a 14-acre field of "Champion" had been manured with 200 loads of farmyard dung, and the growing crop looked like 26 bushels to the acre, showing how desirable it is to manure. The crop is cut by the string-binder, stacked in the farmyard, or stored in the barn, and thrashed by steam at 1s. per bag. The market is local, at about 3s. per bushel. Complaint is made that oats are not separated by the thrashing machine, wherefore their prevalence in the growing corn was to be accounted for; but this breadth will be cut for hay in consequence. The sorrel is stated to have been introduced into the district with New Zealand oats used by the contractors for the railway, and the cavings are burnt to destroy its seed. Preparation is made for potatoes, when they follow maize, by two ploughings, and it is contemplated to get a disc harrow, so as to save the second ploughing. As much farmyard dung is applied as can be spared. Planting takes place from September to November, so as to get crops from December to May. The varieties in favour are "Early Rose," "Brownell's Beauty," and "American Flourball." Weeds are kept down, and a plough with potato-body is used to dig up the crop. The yield is from 4 to 6 tons per acre. This year (1893) £5 per ton has been realised, but the previous year £2 only. For planting, small tubers culled from the main crop are preferred. Oats may be cut for grain or hay, a field of "White Scotch" looking like 36 bushels per acre. Fodder crops of wheaten or oaten hay are taken after maize, ploughing for the wheat from April to July, and for the oats from August to September, sowing broadcast, wheat, 1½ bushels, oats 2 bushels per acre, and harvesting the crop by Wood's mower. The stack is made in the yard, and is thatched with rushes grown on the swamp. The yield is from 1½ to 2 tons of hay per acre, the market is local for chaff, cut by a travelling steam-plant, and sold at from £3 to £3 10s. per ton. Much is used at home for winter feed. Maize follows wheat, ploughing starting in October; the seed, "Early American," is dropped by hand in furrows, 3 feet apart; hoeing is kept going, the cobs are husked in the barn, and the yield is from 30 to 40 bushels per acre. The market is local, at about 3s. 3d. per bushel. The stalks are ploughed in, or, if burnt, the ashes, like those of the cavings, are applied to the orchard. Green manuring and catch crops are not resorted to. Some rye is sown for its long and strong straw, which is used to bind the fruit trees. In the orchard there are grown, besides potatoes, small breadths of various crops, such as ¼ acre field peas, ½ acre English barley, ½ acre Cape barley, and ½ acre rye, the seed from the latter being sold to neighbours at 6s. per bushel, for the growth of green fodder. The straw sells at 6s. per cwt.

Manure is made in the farmyard, and ashes are used in the orchard.

Land is laid down to grass for a rest, particularly the wheat-land, and after two years is completely renovated. Although rye-grass is only sown, an abundance of white clover springs up naturally, and materially assists in restoring the fertility. Five pounds of rye-grass seed, grown on the farm, is used per acre, being sown with some black oats; hay is made the first year,

and afterwards the growth is depastured. Buffalo-grass is good for certain moist spots ; but Mr. Sommerlad regards it as unwise to add it to pasture that has to be ploughed again. As for couch-grass, it dies off on the approach of winter, and is not liked.

The live stock comprise 30 horses, 120 cattle, 6 swine, and 100 head of poultry. Owing to a continuance of a dull market the horses have accumulated, the stock numbering 17 plough, 11 buggy and saddle, and 2 stallions, one of the latter not being of a high type. There are in all 9 breeding-mares. The milking-cattle amount to 31, springers, dry, steers, and youngsters, 89—in all, 130. The prices for cattle are exceedingly low—50s. for a dry cow, and £3 for fats; and the 31 milkers, through having the calves with them all day, only yield 21 gallons daily. The recent opening of a butter factory, and of which Mr. Sommerlad is a managing director, has done away with the dairy, and it is contemplated to build up a dairy herd; but there is a dearth of good milking-stock in the district. The rigour of winter has predisposed cattle to be poor, but Mr. Sommerlad fully intends to reduce the excessive number of unremunerative horses and cattle in favour of a true dairy herd. No sheep are kept, and there are 6 swine, a young boar and sow of excellent Berkshire type; also, 4 young pigs fattening on skim-milk, and on reaching 140 lb. weight will be killed for home-curing. The poultry number 100 head, various pure strains being represented, including Brahma, Spanish, Dorking, Leghorn, Plymouth Rocks, Hamburg fowls, Muscovy and common ducks, and guinea-fowl. A Plymouth Rock hen has laid 131 eggs consecutively. The market is local, eggs fetching at from 6d. to 9d. per dozen, and table-birds 1s. 3d. to 1s. 6d. each.

The orchard is a leading feature of Mr. Sommerlad's farming, he being a trained nurseryman, and has sold much plant stock at good prices locally—indeed, a large proportion of the fruit-trees of the district appear to have passed through his hands. The first orchard was planted seventeen years ago, and the trees selected for the new apple orchard of four acres may be taken as affording a criterion of the varieties suitable. The stocks are home-grown, vigorous, clean in the bark, and free from blemish, appearing to be proof against blight. They stand 4 feet high before branching, so as to allow for ploughing, and the pruning is on the outside, the interior being purposely kept dense so as to shelter the fruit from sun and wind. The trees are allowed a good deal of natural growth without topping. The new apple orchard occupies a gentle slope, the soil being a deep rotten granite, trenched 2½ feet deep, and all boulders extracted, at no small cost. Where necessary there are underground drains, to a total length of 1¼ miles, since clay underlies in places. The trees are spaced 25 feet, and comprise 36 Winter Majetin apples, 24 Frampton, 36 Orange Pippin, 12 Scarlet Pearmain, 12 Beauty of Kent, 12 Lord Mason, 24 Red Caldwell, 12 New England Pippin, 24 Lord Wolseley, and 12 Yeates seedling, 12 Irish Peach, 24 Windsor Pearmain, 24 Five Crown Pippin, 12 Jupp's Surprise, 12 Nonpareil, and 12 trees of mixed sorts ; in all 300 trees. Lord Nelson is a great bearer, and good for table and cooking ; Brown Spice is an excellent baking apple, as is also Beaufort Norfolk ; Five Crown Pippin does very well ; Lord Wolseley is the finest winter apple, and Bismark nearly equally so. In the ten-year old pear orchard there were five trees each of Napoleon, William's Bon Chrêtien, and Evan's Egg. The growth was very satisfactory, but the Windsor pear, as elsewhere, has failed to bear, and therefore has been grafted with better sorts. Plums do very well, and comprise English Damson, Sommerlad's Damson Red German Quetcha, Early

Tippett, Black Prince, Black Diamond, Sweet Damson, Black Orleans, Magnum Bonum yellow, Early Japanese (peach) plum, Frankfort Peach, Blue-gage, Green-gage, Late Orleans, and Cole's Golden Drop.

Cherries do remarkably well, and some seedlings are of great promise. Amongst the varieties are, Bigarreau, Sommerlad's Seedling White, Florence Black,—a great and luscious bearer, and various seedlings. The splendid growth made by some first-year grafts is worthy of notice. There are some forty trees alternating of Spanish Walnuts and Chestnuts. Nursery stock sells at £5 per 100, 15s. per dozen, and 1s. 6d. each. The prices for fruit are: cherries, 10s. per quarter-case, grapes 6d. per lb., peaches 3d. to 1s. per dozen, and 6s. to 8s. per half-case.

Vegetables are grown to some extent, and much assistance is derived in marketing by the Tenterfield Union Store, which Mr. Sommerlad has taken an active part in organizing. Fruits, produce, and poultry are sold by auction. The market day is Saturday, and produce not sold then is kept on sale throughout the week at Saturday's prices.

Bee-keeping is pursued by the third son, who is rapidly getting a mastery of this interesting occupation before launching out on a large scale. There are six hives, Hoffman's self-spacing frames being used, and the frame material is got from Sydney; queens are reared. The extractor is "the Novice," and a good price is obtained locally in glass packages. Miss Sommerlad is proficient in the preservation of fruits, numerous prizes having been won in local competition. Bacon is cured, and has also gained many awards. The pigs are well cared for and cleanly fed. Dry-salting is continued for a week until all the blood is drawn out of the tissues, then strong brine is resorted to, and finally smoking with wood-chips, and a few green gum-leaves. An experiment was being conducted in packing the cured bacon in a cask, with lime sprinkled in layers. The local prices are 6d. for sides, 9d. for hams, and there is room for a much larger output, only 10 pigs per annum being cured.

Mrs. Sommerlad has prepared some true arrowroot, which grows well. There is also a built-in fruit evaporator about to be re-erected in a house by itself. In past seasons it has done good service, and is of so simple a description that any mason can set one.

Bookkeeping is represented by a record of sales and purchases. The labour is provided by the family, one son undertakes the cultivation, a second, the orchard, and a third, bees and bookkeeping. Mrs. and the Misses Summerlad attend to the dairy.

The subsidiary aids are co-operative family labour, sales of nursery stock, butter, bacon, eggs, poultry, honey, various seeds, and partial home repairs.

The points of interest may be enumerated as; clearing of boulders, drainage of a marsh and the orchard. Extended orchard culture, a good class of swine—the preservation of fruit by evaporation and in syrup.

The general management with a view to profit is good. The land represents an original outlay of £600, and the invested profits of sixteen years farming. The annual sales amount to close on £600; in the proportion of general produce, £280; dairy, &c., £160; orchard, £140.

The buildings are suitable, implements well selected, the bacon trade can be expanded, and the importance of a superior milking herd is recognised. The orchard has done well in the past, and the enlargement is based on a wise selection of suitable trees. Not long ago £3,000 was offered for the property and refused.

William O'Meara, Maryvale, Hickey's Creek, 28 miles from Kempsey, Macleay River.

North Coast District.—Place, No. 7; points, 79·77 per cent.; arable, 40 acres; rung, 990 acres; homestead, 2 acres; orchard 1 acre; total, 1,033 acres.

[12 December, 1893.]

Maryvale is a mixed farm in its full sense, in that, whilst 40 acres are cultivated, stock are grazed on nearly 1,000 acres of ridge country mostly rung, and affording a good natural herbage that would probably pay better with sheep than with cattle at the present low prices. Mr. O'Meara, who is a native of the Macleay, has a decided opinion as to the value of having a run in connection with arable land. His views are based upon experience derived from the havoc occasioned by recent floods, in that, whereas instead of harvesting 2,500 bushels of maize he only saved last March 300 bushels, realizing under £30. Had it not been for the cattle on the run returning £160, he would have had no income for the year. The turn over on this farm from all sources in a really good year, may be taken at about £720; so that mixed farming is not to be despised. The farm, moreover, shows how pre-eminently desirable it is to associate a small area of good land under plough husbandry with a pastoral occupation. Furthermore, the manure from produce grown on cultivated alluvials might with advantage be used to make fertile a small additional breadth of poorer forest land each year. Little by little should be the farmer's watchword, but let each little be done well. The local market at Hickey's Creek is very circumscribed, and Kempsey, the nearest port, is 28 miles away; so that it is desirable to have the products of the farm easy of transport. What with 28 miles haulage, freight and charges, 1s. 1d. has to be deducted from each bushel of maize, yet corn is the most suitable main crop of the farm. Pig-raising has been for the past twelve years a leading feature of Mr. O'Meara's management, besides which 400 head of cattle are carried on the run of nearly 1,000 acres; but when prices only average 10s. per annum increase on each beast, instead of a £1, as has hitherto ruled, it is evident that cattle do not pay now-a-days. Sheep being scarce in the North Coast district, Kempsey butchers ship their supplies from Sydney, mutton selling at 4d. per lb. If only a moderate flock comes down from the New England tableland the local market is glutted, for the annual consumption may be put at 800 sheep. The Kempsey forest country affords sweet, sound, and nutritious pasture; but if sheep were generally kept, there would be a difficulty in getting off the surplus.

The floods on the Macleay come suddenly, and the river rises to an extraordinary depth; at Bellbrook, within 3 miles of Mr. O'Meara's last June 63 feet was registered. The scour of that flood which was 30 feet over the growing maize was excessive, ten acres of Mr. O'Meara's cultivated alluvial disappeared, and a neighbour lost the whole of his flat. The country rock is slate, and the undulating ridges near the river soon rise into lofty mountain spurs. The soil on the ridge sides is fairly good, although thin on the top, whilst in the bottoms there are moderate flats of fair soil with water courses not for long dry.

The water frontage of the Maryvale farm to the Macleay and Hickey's Creek is extensive, so that the property forms an ideal mixed farm. The cultivated area, 40 acres in extent, is a narrow flat lying between a steep bank 50 feet high and the boulder bed of the river. The residence is 70 feet above summer level, and stands on the bank just mentioned, which forms the edge of the country proper. From the garden a view is obtained

of the narrow fringe of rich green maizo lying immediately below and the wide desert-like stretch of boulders which forms the bed of the river, generally a very shallow narrow stream. The property was acquired twenty-one years ago under the 1861 Land Act, the flat and all the river frontage being selected together with two or three back blocks in 1875 and 1889 so as to run more cattle, making in all 1,033 acres. The alluvial was primarily covered with a dense heavy brush, and a large proportion of the forest country has been rung.

The deep porous sandy alluvial needs no drainage, whilst the grazing paddocks have such an extensive water frontage as to need no dams. The ridge lands overlie a clay, and if ever cultivated would need underground drainage. Rain-water is conserved in tanks at both the residence and farm buildings, the large underground cistern in the farm-yard being fitted with a pump and over-head tank, which commands the house and garden.

The grazing paddocks are few in number and large, varying up to 300 acres in extent. The fences are of three rail, substantial and well looked after, with gates to the roads leading to the homestead, and slip rails elsewhere.

The residence was put up twenty-one years ago when the property was selected, and consists of two cottages of weatherboard having a narrow fringe of flower garden in front, forming the especial care of an invalid daughter. The whole of the homestead was erected by Mr. O'Meara. The farm buildings consist of a large barn of slabs with iron roof, having an open cart shed at one end. The climate renders a stable unnecessary. There are extensive piggeries having bark or iron shelter to the styes with several large paddocks adjacent. For the poultry there is a good house and yard wired in, kept very neat and strewn with fresh ashes so as to keep down vermin. There is also a forge and workshop, Mr. O'Meara and his brother being both self-taught smiths and carpenters, and many implements and mechanical adaptations made at home testify to their skill.

The wood beam American type of plough is preferred with chilled digging breasts. The Avery Company's 2-furrow does the main work of the farm. A "Daisy Clipper" throwing a 14 in. x 12 in. furrow is much liked, as with three horses it will cover 1½ acres in a day. Hilling up is done by a Moline Company's No. 4 plough. Rowe, of Greenhill, near Kempsey, has supplied an ordinary iron 1-furrow, and one has been fitted with double mould boards for planting corn. A very light home-made plough is used for the garden. The iron plough is fitted to carry a home-made seed dropper with a simple adjustment to control the delivery, obtained by having a movable plug bottom to the cup-hole. The wood harrows and two rollers are home-made, likewise a wooden expanding duck-foot horse hoe, having a hilling mould board on one back tine, and a 6-in. disc coulter on the opposite side to keep the instrument straight, this being an adaptation of Mr. O'Meara's. In the barn there was a large corn-cracker by Richmond and Chandler, a "Veteran" corn-sheller and bagger driven by a horse gear. A small steel wheat mill by W. Corns, of Wolverhampton, a Bentall's chaff-cutter, a home-made arrowroot grater, and a barn truck completes the list. There was a dray and buggy, and a combined truck and slide carried on a pair of wheels. This arrangement was also home-made, and has proved most useful in taking posts, firewood, or any heavy weight. The workshop contains a selection of tools and a forge. There is also a small dairy fitted with a No. 7 hand Danish separator having a capacity of 30 gallons per hour, and it has given complete satisfaction.

No rotation of crops is pursued, maize being taken continuously on the alluvial flat. The area under corn was 39 acres, and the crop looked parti-

cularly well and clean, especial pains being taken to keep down weeds. Yet, owing to the flood, work was behindhand. The varieties sown were "Early Marsden," "Queen of the Prairie," "Red Hawkesbury," and "White Flint." The "Queen" was from last year's crop, the seed having at first been got from the Upper Macleay. The "Marsden" was from Wm. Tree's farm near Kempsey, who exhibited it at the local show, and this is the first season of its growth at Maryvale. The "Hawkesbury" seed came from a neighbour to whom Mr. O'Meara had previously given the variety, and he was desirous after the flood had washed away his crop to have the old strain back again. The land is ploughed in July and is followed by a second planting which takes place in September and October, the square set being preferred. The yield is from 50 to 60 bushels per acre, and the market is Sydney. The stalks are burnt. Some two years ago the question of hilling and not doing so was settled by experiment in favour of the former. Other crops are grown to a minor degree, ½ acre being under potatoes, ½ acre in oats for hay, also some Hungarian millet, which gives a good return. A small plot of beans showed well, and three long rows of tobacco, in all perhaps ¼ acre, were particularly healthy. The seed sown was "Broad Dutch," originally from California, and was given by a friend on the Manning. The leaf was bold and clean, but somewhat holed by grasshoppers. Every day the ripe leaves are picked, a small box in the barn suffices to ferment in, and a screw-jack is used to form a press. The leaf finds a ready sale locally at 6d. per lb. It is evident that tobacco as a crop suits the district. Pumpkins are sown generally throughout the maize, and squash amidst the early maize. "Early Rose" potato does well at Maryvale, and this season some "Conference Surprise" got from neighbours has been planted.

Farm-yard manure is made from sweepings from the cow-yard. That from the poultry pens is kept for use in the garden; while the maize stalks are burnt.

Fodder is not conserved, since there is no need for a store of it, by reason of the live-stock on the grazing lands being augmented or diminished according to the season.

The live-stock comprise 30 horses, 400 cattle, 43 swine, and 377 head of poultry. The horses are 7 heavy draught, 5 light for saddle and buggy, 8 blood yearlings, and 10 blood brood mares. The stock throughout is of a good character, but prices are low. This year 2 heavy draught have been sold at £9 each, and bloods fetch from £5 to £15 for hacks. The cattle number 400, and comprise 4 bulls, 33 milkers, 66 dry and springers, and 300 head on the run. The sales are local and to Maitland buyers, but the prices are very low, £2 being got for a three-year-old beast. Mr. O'Meara does some butchering, killing about 25 beasts per annum, and the meat is sold locally at 2½d. per lb. The calves run with the cows for half the day, from 7 a.m. to 2·30 p.m. The morning milk is put through a hand separator and made into butter. Some cheese is also made, and both butter and cheese are sold locally and in Kempsey, the former fetching seldom over 1s. per lb., and the latter from 5d. to 6d. per lb. A cheese-press has ingeniously been made out of a linen-press, and one dairy serves for both butter and cheese. Pig feeding has for twelve years past been a feature of Mr. O'Meara's farming, and was resorted to because of the difficult haulage of maize to market. There are extensive paddocks and a topping-up yard attached to the piggery. At first bacon-curing was relied on, 6d. per lb. being got locally, but there is less trouble in selling the pigs alive in Sydney. A drover takes them to Kempsey when from four to six months old; freight to Sydney is 2s. per head, and from 18s to 26s. are realised. The number kept is generally about 200 head, the food being pumpkins, squash, and inferior maize, together with the herbage

in the paddocks. Improved Berkshires are preferred, a boar and twelve sows forming the breeding-stock. The flood having destroyed the food supplies, only thirty stores were in hand last December. A number of fowls are kept, a mixture of many breeds, eggs and table-birds being disposed of for barter with itinerant dealers. In addition to 250 fowls and 80 chicks, there were 7 geese and 40 ducks. About three years ago a start was made in bee-keeping, and the present stock consists of 8 Italian hives and 42 black bee; already $\frac{1}{2}$ a ton of honey has been got, and about 30 cwt. more may be expected. Sales are made locally at 6d. per lb., 10 cwt. having already been disposed of. Hive material is obtained from Sydney, and Mr. O'Meara has cleverly utilised the gearing of a discarded Wanzer sewing-machine to run the extractor with increased evenness and rapidity.

Sufficient vegetables for home use are grown on the flat. On the slope of the 50-foot bank, on which the house stands, is placed the orchard, where citrus-trees and peaches grow famously, and top 25 feet in height, the deep sandy silt forming a soil most suitable. Flying-foxes are a pest, and in order to protect the fruit 30-foot scaffold-poles have been erected on the four sides, and six barb wires, at intervals of 18 inches, commencing at the top of the pole, have been stretched. The remains of skin show where the pests have been entangled. A few oranges are sold, and Mrs. and the Misses O'Meara make capital preserves.

The book-keeping consists of entries of sales and purchases.

The labour of this 40-acre plot of cultivation ground and nearly 1,000 acres of run is accomplished by Mr. O'Meara, but since July a brother has assisted, owing to illness in the family having interfered with Mr. O'Meara's continuous attention. A stout lad is employed, and there are no sons on whose labour to rely in the future.

The subsidiary aids may be enumerated as co-operative family labour; sales of butter and cheese; also the exchange of eggs and table-fowls for goods; home carpentry, smith's work, shoeing, implement-making and building.

The points of interest are, a mixed farm comprising a large run and small area of cultivated land wholly attended to by one man; the excellent culture of the arable area, pig-raising on an extensive scale, tobacco-culture, hand-separator, and barb wire to orchard.

The management, with a view to profit, is based on the growth of maize, sales of fat pigs, and running cattle on 1,000 acres of ring-barked country. This mixed husbandry has proved its value during the past year when a flood swept away the maize crop. In the aggregate a fair number of acres scattered in favourable spots over the run might be ploughed, but the area now under crop is quite as much as one man can attend to. It is possible that were the property divided into three farms, each with 40 acres of cultivation land, the returns would be threefold what they now are; but to hire labour for that purpose would probably yield no profit at all. This farm is typical of a very large area in New South Wales, and the good cultivation displayed, and the self-reliance and mechanical skill possessed, have overcome the difficulties entailed by an isolated situation with difficult and costly land carriage. The land was acquired by *bona-fide* selection, and might be valued at £2,500; with all improvements it probably would realise more, whilst homestead, live stock, and working plant may be put down at £1,100, making £3,600 in all. The annual turnover may be taken at £725, composed of maize £250, run cattle £200, horses £25, pigs £200, and sundries £50. These figures suffice to show that mixed farming on Mr. O'Meara's lines is a profitable undertaking.

(In the next *Gazette* will appear the report on the farms under 200 acres.)

MIXED FARMS not exceeding 1,280 acres and over 200 acres.

	Points.	Worboys, T. C.	Wilford, W. H.	Warden, A. F.	Mason, Dr. H. W.	Godfrey, G., senior.	Sommerlad, J. H.	O'Meara, W.
System of underground drainage*	50*	....	50	....	49	50	45	....
Conservation of water, and its economical application...	80	60	36	60	70	70	60	60
Character and condition of fences, gates, &c.	40	36	39	39	26	27	34	29
Plan, character, and condition of farm-house, buildings, &c.	40	39	35	38	33	34	33	31
Kinds of implements, condition, &c.	60	60	57	60	59	58	56	55
System of cultivation, rotation, &c.	80	79	79	79	74	74	76	78
State of crops as to cleanness and cultivation ...	100	99	98	97	95	95	92	96
Productiveness of crops	50	49	50	49	49	49	48	50
Conservation of manure made on the farm	50	49	42	42	47	41	45	31
System of manuring*	50*	....	....	....	....	....	....	....
Means used for conserving fodder	60	50	45	47	50	48	37	28
System of laying down grasses	20	15	20	20	20	17	15	5
Class and condition of stock	50	49	50	50	50	48	41	47
Vegetable and fruit garden	25	23	23	23	14	15	25	16
Mode of book-keeping	20	16	15	15	11	7	8	7
Number and condition of subsidiary aids to farm ...	80	72	59	61	56	64	59	56
Any new point of interest and commercial value, such as new crops, ensilage, &c....	20	16	12	14	18	14	14	12
General management, with a view to profit	125	115	119	110	109	112	113	118
Total points	1,000	827	858	804	830	823	801	719
Highest number of points*...	....	900*	950*	900*	950*	950*	950*	900*
Percentage of points	....	91·18	90·31	88·22	87·36	86·73	83·26	79·77

* NOTE.—The prizes will be awarded to the entries gaining the highest percentage of excellence—not necessarily the greatest total of points. Thus, in the event of any of the improvements indicated with an asterisk (*) being deemed by the judge unnecessary on any competing farm, the points allotted to that subject will not be included in the *total maximum* of points, and the *percentage of excellence* will be calculated accordingly. Thus, a competitor who gains 760 points on a farm that is judged to need artificial drainage would receive a mark of excellence, 760 out of a possible 1,000—equivalent to 76 per cent.; but a competitor gaining the same number of points on a farm that is judged to need *no* artificial drainage would receive a mark of excellence, 760 out of a possible 950—equivalent to 80 per cent.

MIXED FARMS not exceeding 1,280 acres and over 200 acres.

Order of merit.	Competitors.	Drainage.					Water conservation.						Fences, gates, roads.									Homestead.							
		Area.	Drains.	Difficulty.	Special merit.	Total.	Household.	Farmstead.	Paddocks.	Irrigation.	Water-power.	Total.	Style of fence.	Condition of fence.	Condition of gates.	Condition of roads.	Gates or slip-rails.	Hedges, stone walls.	Trees planted.	Special merit.	Total.	Plan, farmhouse.	Character, farmhouse.	Condition, farmhouse.	Plan, farm buildings.	Character, farm buildings.	Condition, farm buildings.	Special merit.	Total.
		15	15	15	5	50	20	20	20	10	10	80	5	5	5	5	5	5	5	5	40	6	6	6	6	6	6	4	40
1	Worboys, T. C.	...	...	...	...	...	20	20	20	...	...	60	4	5	5	5	4	5	4	4	36	6	6	6	6	5	6	4	39
2	Wilford, W. H.	15	15	15	5	50	20	20	20	5	...	65	5	5	5	5	4	5	5	5	39	6	6	6	4	4	6	3	35
3	Warden, A. F.	...	...	...	...	...	20	20	20	...	...	60	5	5	5	5	4	5	5	5	39	6	6	6	6	4	6	4	38
4	Mason, Dr. W. H.	15	15	15	4	49	15	15	20	10	10	70	5	5	5	5	3	...	...	3	26	4	4	4	6	5	6	4	33
5	Godfrey, G., senr.	15	15	15	5	50	20	20	20	10	...	70	5	5	5	5	4	...	...	3	27	6	6	6	5	3	5	3	34
6	Sommerlad, J. H.	15	10	15	5	45	20	20	20	...	...	60	5	5	5	5	4	2	5	3	34	4	4	6	5	4	6	4	33
7	O'Meara, W.	...	...	...	...	...	20	20	20	...	...	60	5	5	5	5	4	...	...	5	29	4	4	4	6	4	6	3	31

MIXED FARMS not exceeding 1,280 acres and over 200 acres.

Names.	Implements.						System of cultivation and rotation.									Cleanness and cultivation.								Productiveness.				
	Tillage.	Harvest.	Marketing—Dairy.	Vehicles—Harness.	Special merit.	Total.	Cereals.	Hay crops.	Fodder crops.	Potatoes and Pumpkins.	Special—Tobacco, Cane, Melons, &c.	Special merit.	Rotation.	Special merit.	Total.	Cleanness of cultivation.	Few rank weeds.	Clean fences.	Clean headland.	Special merit.	Method of cultivation.	Special merit.	Total.	Cereals.	Fodder—Pumpkins, grass.	Potatoes, cane—special.	Special merit.	Total.
	15	15	15	10	5	60	10	10	10	10	10	10	10	10	80	40	5	5	5	5	30	10	100	15	15	15	5	50
Worboys, T. C.	15	15	15	10	5	60	10	10	10	10	10	10	10	9	79	40	5	5	5	5	30	9	99	15	15	15	4	49
Wilford, W. H.	15	15	15	10	2	57	10	10	10	10	10	10	10	9	79	40	5	4	5	5	30	9	98	15	15	15	5	50
Warden, A. F.	15	15	15	10	5	60	10	10	10	10	10	10	10	9	79	40	5	4	4	5	30	9	97	15	15	15	4	49
Mason, Dr. H. W.	15	15	15	10	4	59	10	10	10	10	5	10	10	9	74	40	3	4	4	5	30	9	95	15	15	15	4	49
Godfrey, G., senr.	15	15	15	10	3	58	10	10	10	10	5	10	10	9	74	40	3	4	4	5	30	9	95	15	15	15	4	49
Sommerlad, J. H.	15	15	15	10	1	56	10	10	10	10	10	8	10	8	76	40	4	4	4	3	28	9	92	15	15	15	3	48
O'Meara, W.	15	10	15	10	5	55	10	10	10	10	10	10	10	8	78	40	4	5	5	4	30	8	96	15	15	15	5	50

MIXED FARMS not exceeding 1,280 acres and over 200 acres.

Names.	Manures.									Conserving fodder.												Grass land.			Live stock.					
	Farm-yard stables.	Farm-yard cows.	Farm-yard pigs.	Farm-yard fowls.	Field-ploughed.	Rubbish gathered.	Mud, silt, and fertilisers.	Special merit.	Total.	Resting grass paddocks.	Grass hay.	Cereal hay.	Ensilage.	Mowing machines.	Food preparation, &c.	Horse power.	Barn.	Hay-shed.	Stacks.	Special merit.	Total.	Condition of pasture.	Special merit.	Total.	Plough-horses.	Light horses.	Cattle.	Swine.	*Sheep and special merit.	Total.
	5	5	5	5	5	5	5	15	50	5	5	5	10	5	5	5	5	5	5	5	60	15	5	20	10	10	10	10	10	50
Worboys, T. C.	5	5	5	5	5	5	5	14	49	5	5	5	...	5	5	5	5	5	5	5	50	10	5	15	10	10	9	10	*10	49
Wilford, W. H.	5	5	5	5	5	5	...	12	42	5	5	5	...	5	5	5	5	5	...	5	45	15	5	20	10	10	10	10	10	50
Warden, A. F.	5	5	5	5	5	5	...	12	42	6	5	5	...	5	5	5	5	5	3	4	47	15	5	20	10	10	10	10	*10	50
Mason, Dr. H. W.	5	5	5	2	5	5	5	15	47	5	3	5	2	5	5	5	5	5	5	5	50	15	5	20	10	10	10	10	10	50
Godfrey, G., senr.	5	5	5	5	3	3	2	13	41	5	5	5	...	5	5	3	5	5	5	5	48	12	5	17	10	10	9	10	9	48
Sommerlad, J. H.	5	5	5	5	3	5	5	12	45	3	2	5	...	5	5	3	5	5	4	...	37	10	5	15	10	9	7	9	6	41
O'Meara, W....	4	3	4	5	3	...	...	12	31	...	...	5	...	...	5	3	5	5	...	5	28	5	...	5	10	10	9	10	8	47

MIXED FARMS not exceeding 1,280 acres and over 200 acres.

Names.	Garden & Orchard.				Book-keeping.					Subsidiary aids.																					
	Kitchen garden.	Orchard.	Special merit.	Total.	Sales and purchases.	Ledger.	Farm data.	Balance-sheet.	Total.	Labour—Family.	Do. building	Do. Implement making.	Do. Light repairs.	Do. Heavy repairs.	Sales of dairy produce.	Do. poultry produce.	Do. honey.	Do. vegetables.	Do. fruits.	Do. cereals seed.	Do. garden seed.	Do. potatoes for seed	Do. nursery stock, grass, cane, &c.	Do. live stock.	Hire of implements, &c.	Meat and bacon.	Pig-breeding.	Poultry-keeping.	Butter-making,	Power—horse, water, steam.	Total.
	10	10	5	25	5	5	5	5	20	2	2	2	2	2	2	2	2	2	2	2	2	2	4	10	10	5	5	5	5	10	80
Worboys, T. C.	10	9	4	23	5	5	5	1	16	2	2	2	2	2	2	2	...	2	2	2	...	2	2	8	10	5	5	5	5	10	72
Wilford, W. H.... ...	10	9	4	23	5	5	5	...	15	2	2	2	2	2	2	2	2	1	2	2	...	1	2	10	...	5	5	5	5	5	59
Warden, A. F.	10	9	4	23	5	5	5	...	15	1	2	2	2	2	2	2	...	2	2	2	...	1	2	9	..	5	5	5	5	10	61
Mason, Dr. H. W. ...	2	8	4	14	5	3	3	...	11	...	...	1	2	1	2	2	...	1	2	2	...	...	...	10	5	3	5	5	5	10	56
Godfrey, G., senr. ...	8	5	2	15	5	...	2	...	7	2	2	2	2	2	2	2	...	1	1	2	...	2	...	9	10	5	5	5	5	5	64
Sommerlad, J. H. ...	10	10	5	25	5	...	3	...	8	2	2	2	2	2	2	2	2	2	2	2	2	2	3	7	...	5	5	5	8	5	59
O'Meara, W.	4	8	4	16	5	...	2	...	7	2	2	2	2	2	2	2	2	1	2	2	...	...	...	10	...	5	5	5	5	5	56

Mixed Farms not exceeding 1,280 acres and over 200 acres.

Names	Points of interest.																	Management with a view to profit.										
	Experimental culture.	Nursery culture.	Fruit-culture.	Vegetable-culture.	Any new crop.	Power, steam or water.	Superior implements of tillage.	Superior implements of harvesting.	Tool-shop.	Superior dairy.	Ensilage.	Green crops.	Superior pasture.	Laying down pasture.	Superior hay-barns.	Special merit.	Total.	Tillage.	Cropping.	Live stock.	Marketing of farm produce.	Marketing of dairy produce.	Marketing of orchard produce.	Co-operative labour.	Home repairs, &c.	Class of machinery.	Special merit.	Total.
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5	20	10	10	10	10	10	10	10	10	10	35	125
Worboys, T. C.	1	...	1	1	1	1	1	1	1	1	...	1	...	...	1	5	16	10	10	10	10	6	5	10	9	10	35	115
Wilford, W. H.	...	...	...	1	...	...	1	1	1	1	...	1	1	1	1	3	12	10	10	10	10	10	5	10	10	9	35	119
Warden, A. F.	1	...	...	...	1	1	1	1	1	1	...	1	1	1	1	3	14	10	10	10	10	10	...	5	10	10	35	110
Mason, Dr. H. W.	1	...	...	1	1	1	1	1	1	1	1	1	1	1	1	5	18	10	10	10	9	10	8	...	7	10	35	109
Godfrey, G., senr.	...	...	...	...	1	...	1	1	1	1	...	1	1	1	1	5	14	10	10	8	10	8	4	10	9	9	34	112
Sommerlad, J. H.	1	1	1	1	...	...	1	1	1	1	...	1	...	1	...	4	14	10	10	7	10	9	10	10	8	9	30	113
O'Meara, W.	1	...	1	...	1	...	1	1	1	1	...	...	...	...	...	5	12	10	10	10	10	10	10	10	10	8	30	118

Spraying Experiments at Rookwood.

By A. H. BENSON,
Fruit Expert.

The orchard attached to the Government Asylum at Rookwood having been placed at the disposal of the Department of Agriculture for the purpose of carrying out a series of experiments with different insecticides and fungicides, a meeting of the Pomological Committee was held there on Friday, 4th August, 1892, for the purpose of noting the condition of the trees, and of selecting and marking those which were to be experimented upon.

Those trees, as well as others that were subsequently chosen, have been sprayed once or oftener with various remedies, with the following results:— The first spraying was done on 24th August, the day being fine and the sun somewhat scorching at intervals, but there was little wind. Six apricot-trees were first sprayed for the shot-hole fungus, three trees being sprayed with the Bordeaux Mixture, and three trees being sprayed with the IXL Remedy. All the trees sprayed were on the point of bursting into flower, and received a thorough spraying. It was my intention to spray these trees again just as the fruit was setting, but other official business prevented my doing so, so that the trees were sprayed only the once. The result of the spraying with the Bordeaux Mixture has been very satisfactory, one of the trees sprayed being quite free, and the other two only slightly affected. The IXL Remedy was not as efficacious, though the trees are certainly less diseased than those unsprayed.

Five pear-trees were next sprayed with the same remedies—two with the Bordeaux Mixture and three with the IXL—for pear scab (Windsor pear blight), the trees, in addition, having a quantity of lichen growing on them and a few greedy scales (*Aspidiotus rapax*). It was intended to spray these trees again just as the fruit was setting, but, like the apricots, they only received the one spraying. The lichen growing on the trees was killed by both remedies, and the trees sprayed with the Bordeaux Mixture are certainly freer from pear scab than most of the trees unsprayed, but this remedy failed to kill the scales. The IXL Remedy, however, killed a portion of the scales, and had apparently a good effect on the scab, as the trees are not badly affected.

Five pear-trees badly affected with greedy scales were next sprayed, the remedy used being "Rovery's Scale Blight Exterminator," applied at the strength recommended in the directions supplied with the remedy—that is, 1 quart tin to 6 gallons. At this strength it is certainly too strong, and I should advise 10 gallons in the place of 6, as the strongest that it is safe to use it without fear of injuring the trees. The remedy contains arsenic in a

soluble form, and is very caustic. It is certainly death to all scales, as black and greedy scales were dried right up in forty-eight hours, but it will have to be used with great caution and very much diluted when the leaves are out, as at the strength used I found it killed all the weeds that the spray got on to. At the strength used two of the trees were injured, fully one-third of the buds being killed.

The Lisbon lemon trees, one orange, and one Emperor mandarin were next sprayed with kerosene emulsion—1 gallon of kerosene in 16 gallons of emulsion—for various scale insects with which they were very badly infested. No injurious effects were caused by using the emulsion at this strength, and the application was repeated on 6th September. A large number of scales were killed by the two applications, but not all.

The next trees sprayed were a shaddock, a scarlet mandarin, two Emperor mandarins, a thorny mandarin, and a cumquat, the remedy in this case being the resin, soda, and fish-oil wash (No. VIII, Insect and Fungus Pests, Pamphlet), as recommended for citrus-trees. These trees were badly infested with several varieties of scales, and were only sprayed the once, and the result is more satisfactory than the two sprayings with the kerosene emulsion, as far as the number of insects killed is concerned, but a number of leaves were thrown down by its use. The whole of the citrus-trees experimented upon were a very unsatisfactory lot to treat, as they were more dead than alive, the cold undrained clay in which they are planted being unsuited to their growth, and the scales were so thick on them as to form a kind of outer bark on all the branches.

Five peach-trees, badly infested with peach aphis, were next sprayed with the resin and soda wash, using a triple cyclone nozzle, so as to reach as many of the insects as possible. The trees were just budding out, and an occasional flower showing, and every bud was covered with aphis. Many trees adjoining those sprayed were infested, so that although the remedy destroyed large numbers of the insects, they multiplied so rapidly that the spraying did little to keep them in check, even though these same trees were resprayed on the 25th, and again on the 29th. The spraying on the 25th was done with a Nixon nozzle, using as much force as possible, the object being to see if the insects could not be clean washed off the trees, but the results were not more satisfactory than when the triple cyclone nozzle was used, and as the latter is more economical to use, that is to say, will cover a tree completely with less material than the Nixon, it is the best to use in this case.

The following day, 25th August, spraying was continued, the weather being fine, but rather windy. The five peach-trees just mentioned were again sprayed, and one other peach-tree, the Flat China, which was more advanced than the others, and which was completely covered with aphis, was sprayed with Upfold's Tree-pest Exterminator—1 gallon in 5 of mixture—with the result that large numbers of aphides were killed, but both the leaves and fruit were scorched more or less, showing that this remedy should not be used at as great a strength on peach-trees, nor should it be applied on a windy or sunny day. This tree was not sprayed again, but when lately examined, though apparently nearly dead, every bit of young growth was covered with aphis.

Four pear-trees, badly infested with greedy scale, were next sprayed with the resin, soda, and fish-oil remedy (winter strength for deciduous trees), and this dressing was repeated on 6th September. The result of these two applications is that the trees were not injured in any way, but all the scale insects were killed. This remedy has, however, no effect as a fungicide, as the trees sprayed are badly attacked with pear-scab.

Three pear-trees were next sprayed with Redwood's Specific, as per instructions sent with the wash. The trees were covered with greedy scale, which were seemingly uninjured by the dressing, and the trees are badly affected with pear-scab.

Eight apple-trees, badly blighted with the American blight, or woolly aphis, were next sprayed—four with Upfold's Mixture, and four with the resin and soda wash. The Upfold's Mixture was used at a strength of 1 gallon in 5 of the mixture, and the resin and soda of the strength recommended by the Department. Both remedies were applied by means of the Nixon nozzle, the insects being completely swept from the tree and killed outright. On the 6th September, a few specks of the insects being seen, the trees were again sprayed and completely cleared, both remedies being efficacious in destroying the insects. These trees on being lately examined were found to be nearly as bad as if they had not been touched, showing that these remedies simply keep off the insects for the time being, and unless all the trees in the orchard are dressed, and the insect is kept in check, whenever and wherever it makes its appearance, they will not be entirely efficacious. The trees sprayed were surrounded with dirty trees that were not sprayed, so that the insects returned in the winged form from them and rapidly spread.

Four pear-trees, badly affected with greedy scale, were next sprayed with the Victoria Tree-wash, and the application was repeated on 6th September. This remedy seems to have had no effect, beneficial or otherwise.

The third spraying took place on 29th August, the day being fine for the first part, and showery later on. Five peach-trees were first sprayed with the resin and soda wash for the third time, then a single peach-tree was thoroughly sprayed with a strong solution of soft-soap and water, applied hot, and with as much force as possible, but the effects were no more satisfactory than the other remedies. Seven peach-trees were next sprayed with Upfold's Mixture, one part in five, but the results were no better than those obtained by using the resin and soda wash.

The fourth and last spraying was done on 6th September, the weather being somewhat showery; and the sprayings consisted in second applications of kerosene emulsion on citrus-trees; Victoria Tree-wash on pears; resin, soda and fish-oil wash on pears; and the resin and soda and Upfold's Washes on the apples for woolly aphis. No peach-trees were sprayed, as the day was not suitable.

The general results of the spraying may be briefly summarised as follows:—

First.—Scale insects on deciduous trees were effectually destroyed by spraying once with Rovery's Scale Blight Exterminator, and by spraying twice with the resin, soda, and fish-oil wash. The IXL Remedy partly destroyed the scales, but the Victoria-tree Wash, Bordeaux Mixture, and Redwood's Specific destroyed few, if any. Second.—Scale insects on citrus-trees were treated fairly successfully with two sprayings of kerosene emulsion (1 in 16), and with one spraying of the resin, soda, and fish-oil wash. The latter remedy proved most efficacious, but it is apt to throw down the leaves if applied on a hot or windy day, and it should only be used when the tree is partially dormant, and not when it is making new growth. Third.—Shot-hole fungus on the apricot is prevented by the use of the Bordeaux Mixture, applied just as the fruit-buds are bursting. A second application, just as the fruit is setting, in most cases will be all that is necessary. Though only one application was made, the results were satisfactory. The IXL Remedy had also a beneficial effect, but not equal to that produced by the Bordeaux Mixture. Fourth.—Pears sprayed with the Bordeaux Mixture and the IXL Remedy were less affected with pear scab (Windsor-pear blight),

on the foliage than trees that were not sprayed, but I could not see that any effects were produced on the scab by the Victoria Tree-wash, Redwood's Specific, resin, soda, and fish-oil wash, Rovery's Scale Blight Exterminator.

Fifth.—Both Upfold's Tree-pest Exterminator and the resin and soda wash killed the peach aphis, but neither remedy was altogether satisfactory. Neither remedy can be applied when the tree is in bloom, or even when the flower-buds are bursting, without injury, and they can only be applied on a dull day, or during the evening, or the young leaves and fruit will be injured. These remedies are likely to be of most value when used to kill the insects that are found on the trees during winter, as, if these are killed off then, the trees will have a better chance, as the buds will get a start before the insects are sufficiently numerous to destroy them. In the case of these insects the great harm is done just as the buds are bursting, when in bad cases every particle of young growth is completely covered with insects, and often destroyed by them.

Sixth.—Both Upfold's Mixture and the resin and soda wash will completely destroy all woolly aphis for the time if applied with force and by means of the Nixon nozzle, but in order to be thoroughly successful the whole orchard must be cleaned, and the insects persistently fought, whenever and wherever they may be found, when, if the orchard is not surrounded by dirty and neglected orchards, the woolly aphis will not give much trouble—of course, taking for granted that the roots on which the trees are worked are clean. The pump used for carrying out the experiments was a Nixon No. 3, and the nozzles used were the Nixon and the triple cyclone. Only one line of hose was used, the spray being always applied with as much force as possible, and in order to distribute the spray easily, evenly, and economically, a 7-foot bamboo extension was used. Throughout the experiments the pump and nozzles worked satisfactorily.

Cider.

By ALBERT H. BENSON,
Fruit Expert.

The manufacture of cider as a subsidiary aid to the fruit-growing industry of this Colony has been entirely neglected by our fruit-growers, and yet it is an industry that is well worth the careful attention of our fruit-growers, especially those of the colder districts of the Colony, and also those of districts that are far from a market, and where the expense of marketing the fresh fruit takes all the profit, so that, rather than run the risk of a probable loss, the grower often allows the fruit to lie under the trees and rot. In many of the colder districts of this Colony the apple grows in the greatest profusion and to the greatest perfection, and that often with very little care being bestowed either on the pruning of the trees or cultivation of the orchard, and it is here especially that the growing of the best kinds of cider apples and the manufacture of cider should prove a paying industry. One of the chief reasons that cider has not been made in any appreciable quantity is, I believe, the want of suitable varieties of apple, and not the want of the knowledge of how to make it, as amongst our fruit-growers there are many Hereford, Devon, and Somerset men, who are thoroughly acquainted with its manufacture in the Old Country. In order that suitable varieties of cider apples may be obtained in this Colony, I may state that it is the intention of the Department of Agriculture to obtain a number of the best varieties of cider apples, which will be planted out at the experimental farms, and scions from them will be distributed to fruit-growers who are desirous of testing them.

By cider, I mean the pure unadulterated juice of the apple, made from sound ripe fruit, and sufficiently fermented to keep sound, and yet not to be of a highly intoxicating nature—in fact, a drink that is admirably suited to the requirements of this climate, and one that is far better, more wholesome, and more thirst-quenching than the heavy imported beers and spirits so largely used.

The making of cider is not at all a difficult matter, provided that proper care and attention is given to it, that it is made from suitable fruit that is sound, clean, and thoroughly ripe, and that the mill-press, fermenting-vats, and casks are kept scrupulously clean. Cider-making is in many respects very similar to wine-making, and to anyone going in for it I cannot give better advice than to recommend them to carefully peruse the articles on wine-making, and the treatment of the wine in the cellar, by Mr. J. A. Despeissis, that have appeared in the *Agricultural Gazette.*

Though cider of a kind may be made, and often is made in England, from a general mixture of all the different kinds of apples grown in an orchard, yet, if a first-class article is required, the varieties must be selected, and not only selected, but they must be mixed together in the right proportion, which varies with different soils. The best soil for cider is a reddish or brownish loam of medium texture, with a clayey loam or marly loam subsoil. Gritty or gravelly soils are not suitable, as they produce a thin, poor cider of light colour—usually very acid—and often keeping badly. The

necessary qualifications of a good cider apple are, a large amount of juice, rich in sugar, a soft flesh that is easily crushed, a highly-coloured juice, or bright red skins to give colour, and a strong-growing and prolific tree as free as possible from woolly aphis. When tested, some of our local seedlings are likely to prove of value, notably a very showy local apple called Jupp's Surprise, which has all the qualities of a good cider apple.

Should, however, any fruit-grower like to test the cider-making qualities of the apples he is growing, rather than allow them to go to waste, he may easily do so, and in order to describe the process of its manufacture, I will endeavour to show as briefly as possible the whole business of cider-making, as conducted in the South of England, and in which I have many times assisted. The apples when ripe are allowed to fall from the trees, the fall as a rule being to a great extent lessened by the grass growing under the trees, but here it will be advisable to lay straw or sheets under the trees, so as to break the fall, and prevent as much bruising as possible, the trees being then shaken sufficiently to detach all ripe fruit, but not so hard as to shake off the unripe.

In order to make good cider, the bruising of the fruit should be prevented as much as possible, as bruised fruit rots, and rotten fruits imparts a bad flavour to the cider if present in any quantity.

After the fruit has either fallen or has been shaken down, it is gathered up and placed in large heaps to thoroughly ripen, when it is taken to the mill and crushed. The mill is worked either by hand or by power, usually the latter, and it consists of two pairs of rollers. A smaller pair of fluted iron rollers through which the fruit passes first, and which cut and crush the fruit, after which it passes through a pair of heavy granite rollers, and is thoroughly crushed, so as to allow the juice being readily extracted. The pummice, as the crushed fruit is now called, is next placed in the press, and built into what is termed a cheeze, which consists of usually six or seven layers of pummice, from 7 to 8 inches thick, which are kept in place, one on top of each other, by means of hair-cloths made for the purpose, or by clean wheat straw, if straw is used. The cheeze is made as follows:—A collapsible square framework the length and breadth of the cheeze to be made is placed on the bed of the press, and a quantity of pummice is placed within it, and evenly distributed. Next, a quantity of clean, sweet, wheat straw, which has been carefully shaken to remove all dust and superfluous cavings, is placed evenly round the framework, about half of its length being allowed to protrude all round outside of the framework. More pummice is then placed on the straw till the framework is tightly filled, the pummice being pressed with the hand into all crevices. The straw overlapping the frame is now turned in and kept in its place by placing a little more pummice on it, and the first cake of the cheeze is completed. The framework is now raised and kept in its place by means of sharpened sticks about 1 inch in diameter, and 16 to 18 inches long, which are inserted into the lower cake. The operation is repeated till there are six or seven cakes in the cheeze, which is usually as many as the press will hold. The cover of the press is now placed in position, but the press is not tightened, or only sufficiently so to keep the cheeze from slipping. Usually the cheeze is not pressed for some hours after it is built, as the colour of the cider is improved thereby. The presses used are fitted either with single or double screws, and the pressure is applied by means of long levers acting directly on the screws, so that a very strong pressure can be obtained. After the first pressing the cheeze is trimmed usually with a sharp hay-knife, the trimmings being broken up and placed on the top of the cheeze, where they are kept in position by straw

bands, and the cheeze is again pressed. The pressings and trimmings are continued till no more cider can be extracted, when the refuse is usually thrown on the manure-heap. Some makers keep the first pressing by itself, as it is the best of the cider, and the second and subsequent pressings are kept for the use of the men working on the farm. In this case, after the first pressing the cheeze is taken right down and built up again, a quantity of water flavoured with hops being poured over it, and the whole again tightly pressed. When hair-cloths are used the operation is simpler than with straw, and the cider is more rapidly extracted, but great care must be taken to see that the cloths are kept scrupulously clean. The juice, as expressed from the cheeze, runs into a large trough or tub, from whence it is taken to the fermenting-vats, which hold, as a rule, from 150 to 200 gallons. Before placing the juice in fermenting-vats it is strained through a hair sieve, so as to keep back as much extraneous matter as possible. The juice is allowed to remain in the fermenting-vats about three days, or rather till the thick scum which rises to the surface commences to crack, when it is time to draw off the cider and check the fermentation. On removing the cider from the fermenting-vats it is placed in thoroughly sweet and clean casks, which are filled up to the bung, which is not closed at first. A slight fermentation will still continue, and if any working takes place through the bung the cask must be kept full by more cider being added to make good the loss. After about three weeks the cider will stop working and get clear, a sort of glaze or crust forming on the surface. It must now be racked at once into another perfectly sweet cask, which must be quite filled. The bung should be lightly put in at first, and if after a few days working has ceased, driven tight, but a spile-hole should be left open for a day or two longer, and if there is then no appearance of the cider working it must be driven tight. Should, however, the cider continue to work it must be again racked, as it is only by racking that the fermentation can be stopped. A little charcoal is sometimes placed in the cask now. The cider should now be allowed to stand in a cool cellar till spring, when it must be again racked, as at the time of the apple blossoming it will start working. If not clear now, and it is wished to bottle it, a little isinglass or Spanish clay is added, which will soon clear it. Bottling should be done now, at the spring working, as the cider will thereby be sparkling, but if not bottled till later it will be quite still. In bottling sparkling cider do not cork as soon as filled, but allow the bottles to remain open for an hour, when cork and wire carefully, storing the bottles in a cool cellar, packed, if possible, in dry sand. Well-bottled sparkling cider is not to be despised, and thousands of dozens, after manipulation to produce the right colour, are sold annually in England as genuine champagne, and often take a very good judge to detect them.

Cider requires to be kept in a cool and well-ventilated cellar, and all the utensils, casks, &c., should be kept perfectly clean. All casks after having had cider removed from them should have the lees removed and be thoroughly washed out. If sour, boiling water containing carbonate of soda should be used, and if not perfectly sweet or casky they should be sulphured. The same attention that is necessary in the case of wine-casks is necessary in the case of cider-casks.

The cider that is not bottled should be sold after the spring racking and used, as it is not desirable to keep it longer than a year, as old cider in wood usually gets very hard and sour, and often ropey. From hard and sour cider very good vinegar can, however, be made—a vinegar that is only surpassed by that made from wine.

Poultry.

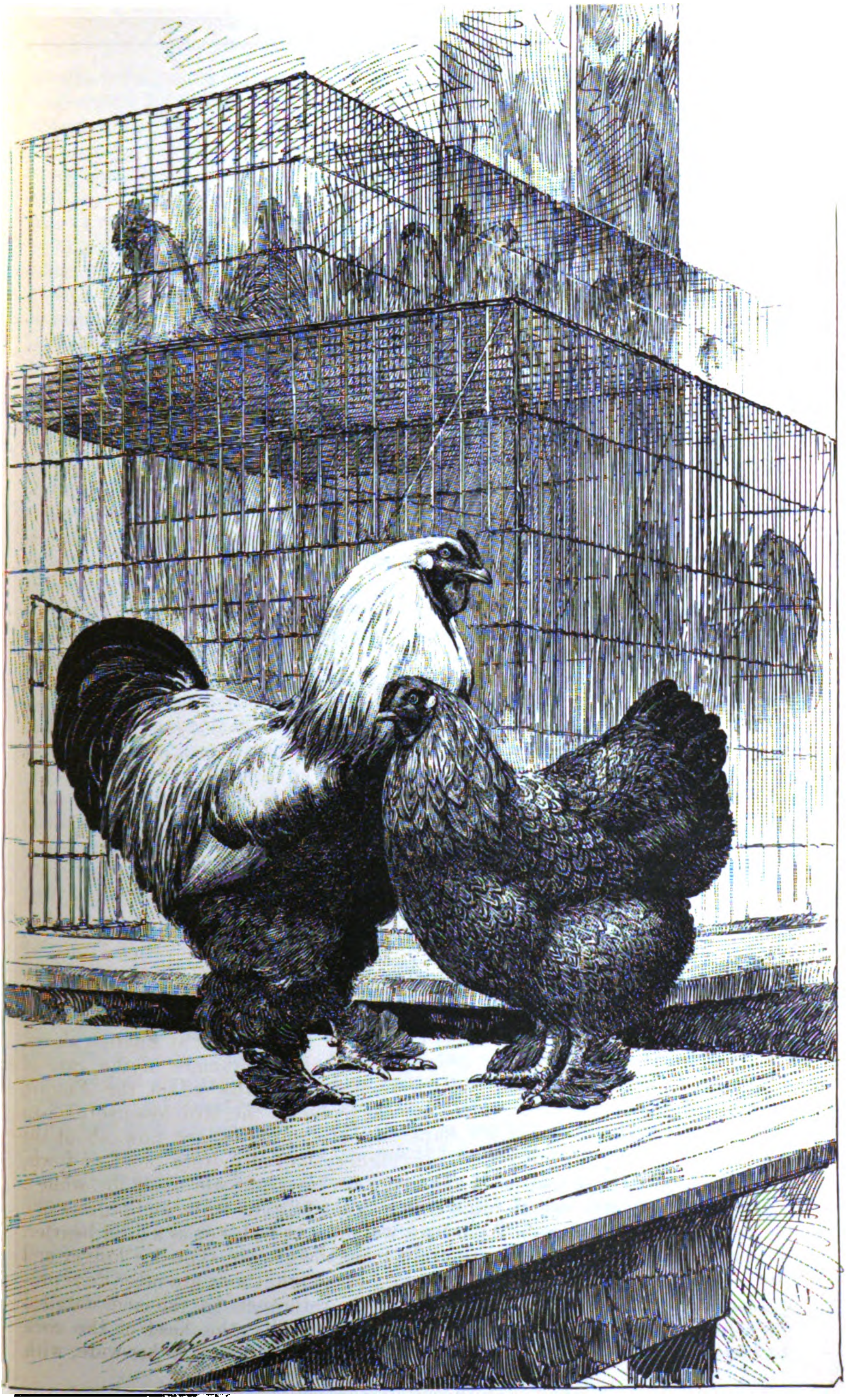
By SAMUEL GRAY,
Sub-Editor.

Brahmas.

This is another breed as to which a most bitter controversy raged for years after the first appearance of some specimens. Without going into the merits of the case for either party, it may be stated that whereas, on the one hand, the Brahma was claimed as being of Chinese origin, and related to the Cochin family, other fanciers claimed it as a purely Indian breed. After a careful perusal of the *pros* and *cons.*, I have come to the conclusion that the birds did come from the banks of the Brahmapootra, in India, and were landed in New York somewhere about the year 1846, and that they are an entirely distinct breed from the birds known to us as Cochins. This is the more readily apparent from a comparison of the earlier types before our fanciers had sacrificed almost every beneficial characteristic to feather. Even at the present day the Brahma has not been bred to that excess of feather which is considered so necessary in the case of the modern Cochin, making due allowance for the softer feathering of the latter, but I am confident that the exhibition Brahma of to-day is neither so hardy nor such a good layer as the earlier specimens were found to be.

There is still another point in connection with Brahmas which it is necessary briefly to refer to. A doubt is prevalent as to whether or not the light and dark Brahmas are of the same origin. From inquiry and reference I incline to the belief that both light and dark varieties were obtained by means of selection from birds of the same original stock, and that careful breeding has succeeded in firmly establishing the two varieties.

This breed is one which owes its present high position to American breeders, there being not the slightest doubt that the first specimens which came to England were obtained from America. It is interesting to note that the American type of Brahma, even at the present day, is a much closer and less fully-feathered bird than that which takes prizes at English shows, although, to judge from the action of American fanciers in the case of Cochins, there is some fear that they will gradually adopt the English feathering, and so, in my opinion at least, render the bird less useful than ornamental. The weight and shape of both varieties are now about the same. The former is claimed to run higher than any other breed of fowls, even Cochins, a full-grown cock requiring to tip the scale at 12 lb., while a cockerel at 6 months old should weigh a least 7 lb. to 9 lb., and pullets 6lb. to 8 lb., and in each case the American weight may be taken as a little heavier. As regards shape, the chief distinction from the Cochin type is a longer and more arched neck, and the fanlike tail, although there are other less prominent differences, which will be noted on reference to the more detailed description which is appended. Speaking generally, the head of the cock bird cannot be too small in proportion to the body, the top rather wide, with



DARK BRAHMAS.

a slight falling over the eye, the whole being rather short and arched; the comb should be treble, and lie close along the top of the head, not peaked behind, as in the Hamburg; the deaf ears should fall below the wattles; the neck should be fairly long, and distinctly arched, and the hackle should sweep down from the head, and flow well over the back and shoulders; the back should be wide, and flat across, but very short, the saddle appearing to take its rise almost from the base of the neck; the saddle-feathers should be long and abundant, so as to flow well over the points of the wings; the breast of the cock should be full, deep, broad, and rather projecting, the breast-bone being well set down between the thighs; the shoulders should be rather prominent. The vulture hock is a defect in this breed, as with the Cochin, though the hock should be well covered, and provided these feathers are not hard, and form a sort of spur, there is nothing objectionable.

Through the kindness of Mr. J. E. Pemell, a very successful New South Wales breeder of Brahmas, I am able to give a very accurate illustration of two of his birds of the dark variety. It will be seen that they are not in the best of condition, which is easily accounted for by the season, but the Departmental artist, Mr. E. M. Grosse, has given the birds as he saw them, and any fancier will be able to judge for himself what the birds would look like in the early spring. The male bird is still a cockerel, and won the 1st prize in the cockerel class at the last Sydney show; the hen, also, is a 1st-prize winner of some note.

On the question of utility, the weights I have already mentioned, and which are often exceeded, stamp the Brahma as a good table-bird, and it is a far better layer than the Cochin. It is also a more active, and, I think, a hardier bird. I am of opinion that it will live and thrive in any part of the Colony with fair attention, and, provided it has shade in the warmer, and dry quarters in the colder and damper districts. At the same time, I do not consider it a farmers' fowl, and should only recommend it wherever feather-legged birds are preferred by the person desiring to keep a few to supply the family with table-birds and eggs on a small scale. They should never be allowed to roost on perches; a good wide flat board, with a light straw litter, is the proper thing, and this may be made so as to cover the nesting-boxes. They are certainly handsome birds, whether light or dark, and breeding them with a view to exhibition will be found a most interesting hobby.

I append Lewis Wright's "Schedule for judging Brahma":—

General Characteristics of Cock.

Head and Neck.—General appearance of head very short, small, and intelligent; beak short, curved and stout at the base; comb triple or in three ridges, resembling three small combs, the centre being the highest, and the whole small, low, and firm on the head, the centre ridge *perfectly* straight and neatly serrated; wattles moderately long, thin, and pendant; deaf-ears large, and hanging below the wattles; neck well proportioned and finely curved, as in a spirited horse, and very thickly furnished with long hackle, which should flow well over the back and shoulders.

Body.—General shape large and deep, but tight and compact in make; back broad and short; saddle very broad and large, with a gradual and decided rise to the tail, so as to form no angle with that member; wings larger than in Cochins, but still small and neatly tucked up, with secondaries carried well under the primaries; breast full, prominent, and reaching well down.

Legs and Feet.—Thighs large and well furnished with fluffy feathers, the hocks being entirely covered with soft curling feathers, but free from stiff quills (vulture hock) which are particularly objectionable; shanks rather, but not too short, thick, wide apart, and

heavily feathered down the outside, the feathering to start out well from the hock, and continue to ends of outer and middle toes; toes large, straight, and well spread out.

Tail.—Much larger than in Cochins, but still small, carried nearly but not quite upright, and the top pair of feathers curving outwards as in the tail of the black cock; sickles very short, and not curving much downwards, but lesser sickles and tail coverts very abundant, covering nearly the whole side of the tail.

Size.—Very large, ranging from 11 lb. to 15 lb. in cocks, and 8 lb. to 11 lb. in cockerels.

General appearance.—Very symmetrical and compact.

Carriage.—Noble and commanding, with the head carried very high.

General Characteristics of Hen.

Head and Neck.—General appearance of head very small, peculiarly arch and intelligent, caused by a slight fulness over the eye, which should on no account tend to coarseness; beak and head rather short, as in the cock; comb as small as possible, a large loose comb being particularly objectionable; deaf-ears well developed; wattles nicely rounded, neat, and free from any folds; neck short, very full in hackle, and free from twist in the hackle.

Body.—General shape square and neat; back wide, flat across, and short; cushion broad and large, not convex or globular as in Cochins, but rising to the tail; wings moderate in size, and well tucked into the fluff and cushion-feathering; breast very prominent, low down, and full.

Legs and Feet.—As in cock, but as short as possible.

Tail.—Rather short, so as not to rise much above the extremity of the cushion, and carried nearly upright.

Size.—Very large, ranging from 8 lb. to 13 lb. in hens, and 6 lb. to 9 lb. in pullets.

General appearance.—Massive and square, but neat and compact.

Carriage.—Matronly and dignified, both head and tail being well carried up.

Colour of Dark Brahmas.

In both Sexes.—Beak yellow, yellow with a dark stripe, horn colour, or black; eyes pearl or red, the latter preferable; comb, face, deaf-ears, and wattles a brilliant red, as little obscured by feathers as possible, the beard or feathers under the throat not to exceed moderation.

Colour of Cock.—Head silvery white; hackle white, heavily and sharply striped with rich black, as free from white streak in centre as possible; saddle feathers the same; back and shoulders silvery white, except between the shoulders, where the feathers should be black laced with white; upper wing-butts black; bow, silvery white; bar, or coverts, glossy black shot with green; secondaries white on outside web, which is all that appears when wing is closed; black on inside; the end of every feather black; primaries black except a narrow white edge on outside web; breast, under-parts and leg-feathers glossy black, as intense as possible, or black evenly and sharply mottled with small spots of white; fluff black, or black laced or tipped with white; (all black in the under-parts preferable for exhibition); tail black, richly "shot" or glossed with colour, white not a disqualification, but very objectionable; shanks a deep orange-yellow.

Colour of Hen.—Head and hackle, silvery white, heavily and sharply striped with black, the marking to extend well over the head; tail black, the top pair edged with grey; rest of the plumage a silver-grey, dull-grey, or steel-grey grained-colour, accurately pencilled over in crescentic form with steel-grey, blackish-grey, or black; the breast to be perfectly marked, and free from streaks up to the throat; a chestnut tinge not objectionable, if of a rich and not dingy character; the leg-feathers to be pencilled as the body; shanks a deep yellow, with or without a dusky tinge.

VALUE OF DEFECTS IN JUDGING.

Standard of Perfection.

A bird ideally perfect in shape, size, colour, head and comb, cushion or saddle, leg-feathers, tail, &c., and in perfect health and condition, to count in points ...	100
If of extraordinary size, add on that account	5

Defects to be deducted.

Bad head and comb (comb to count 7 in cocks and 5 in hens, ...	12
Scanty hackle	5
Want of cushion	7
Want of fluff	6
Want of leg-feather	15
Vulture hocks	5
Bad shape or carriage of tail	6
White in tail	10
Primaries out of order*	15
Pale legs	8
Curved toes	10
Stain of white in deaf-ear	5
Splashed or streaky breasts in dark, or black specks in light	15
Shank-feather (in dark hens) not pencilled as the body	4
Other faults of colour	10
Want of size	20
,, general symmetry	15
,, condition	12
,, ,, (if total)	35

* This refers to primaries merely "slipped" outside the wing. For primaries actually twisted on their axes, see list of disqualifications below.

Disqualifications.—Birds not tolerably matched; primary feathers twisted on their axes; utter absence of leg-feather; pinky legs; large red or white splashes in dark birds, or conspicuous black spots in light; round or crooked backs; wry tails, crooked bills, knock-knees, or any other bodily deformity; any fraudulent dyeing, dressing, or trimming.

Silk Growing.

In consideration of the difficult tasks often undertaken by novices in silk culture, and in sympathy with their want of knowledge and experience, to meet inquiries the following suggestions and notes for their assistance are submitted:—

In the very first place it is most desirable, rather than discuss the "rearing of silkworms" (which is in any case premature at this moment), to point out, first, to seekers for information, the far greater importance of "growing plenty of mulberry" to supply the large quantities of leaf that will assuredly be in demand, whether for the rearer's own use or for sale to others, who, if food leaf should be available, would buy the leaf and raise the silkworms. This demand for leaf is quite as certain to happen as that wheat grown in a new quarter is sure of finding a mill to grind it.

The kinds of mulberry best to grow in any particular locality can only be learned by reference to competent authority. As the Government has already determined and proclaimed that the growing of silk is a "public purpose" within the meaning of the Land Act of 1884, and has appointed a superior officer to attend specially to inquirers, owners of land, farmers, and others generally, should communicate in writing with the Department of Agriculture, in Macquarie-street, stating their desires and intentions, the character and extent of ground, their purpose to devote to the growth of the mulberry so much land and so much money if necessary, climate, locality and aspect, soil, if fenced, &c., which would receive due attention.

Probably this line of action would materially lessen people's labours and mistakes, as well as contribute to their success.

While the mulberry trees are growing, persons of both sexes seeking the addition of a merchantable and profitable fresh source of gain from their land should obtain practical instruction and experience in the pruning and general management of mulberry trees while the trees are yet young, as well as their treatment afterwards, besides learning proper and economical methods of rearing worms from the egg (or after hatching if supplied with young live worms) through the various stages of caterpillar while feeding, and during their moults, &c., to the cocoon, moth, and egg again.

Much that would be instructive and useful to any inquirer may be learned by carefully reading the Report on Silk Culture by Walter Scott Campbell, Esq., F.L.S., published by the Government.

Every idea or project should be discarded and discouraged of beginning silk growing or even a mulberry plantation on any smaller scale than would be fully adequate to yield a sensible beneficial monetary return. It is time effort should be avoided which would necessarily be abortive and unproductive, and discredit the industry, as has so often been the case already. It is manifest that to grow a single potato, or a single plant of corn, or of any vegetable or fruit as an experiment, is only trouble without profit, beyond the mere pleasure of seeing them grow.

Hence it may be useful to mention :—

That the "unit" by which silkworm rearing is reckoned means one ounce of 437½ grains, avoirdupois the "heavy pound" of 7,000 grains = 16 ounces.

An "ounce of eggs" (known technically as "graine" or "seed") means from about 38,000 (perhaps fewer) or 40,000 to about 52,000 or 54,000 eggs, according to breed, race, and quality, 40,000 being usually regarded as one ounce.

Two ounces of eggs, say about 80,000, is by all experience fully enough for any one rearing, in any one place, at one time, and such a rearing should only be attempted by a competent rearer, where there is abundance of leaf ready grown and close at hand, to be gathered as needed.

Crowding or having excessive numbers near together occasions more or less weakness and sickness, and is a sure cause of losses in several ways, and often of disease. In any management worthy the name each and every worm must have its abundant supply of fresh air, both for its own comfort and its own health, as well as of the whole rearing, by the removal and dissipation of the vapours continually thrown off.

Whatever the number of worms, all of one rearing should each and every one be of exactly the same age, hatched out on one (the same) day, go through all their stages contemporaneously, each one neither sooner nor later than its fellows, and become cocoons, moths, and eggs again—in each and in every stage the same days.

To effect this demands good management, skill, and care, which can only be learned by practical experience.

The more or less perfect, intelligent, and masterful, the experience truly acquired, so will be the economy and profit of the rearing. The more it comes short of good management the greater the confusion and waste, labour, trouble, and expense, with proportionate less results in silk and in money.

A plantation should be from 5 upwards to about 20 acres or more, and all of one kind of mulberry, ninety trees would be enough on one acre of first-quality, deep, rich, land well drained and favoured with a good regular rainfall, and 120 to 150 trees on fairly-good land.

The value yearly of mulberry leaf is hard to state with any degree of accuracy. The quality, from obviously varying considerations, must vary greatly, and quantity likewise. It may be sufficient to say that the quantity of leaf from an acre well grown is very considerable, if sold at 10d. or 1s. per cwt. it is reckoned to yield about £3 or £4 to £7 or £8 more or less, as may be, per acre, that is, if sold by the grower of the leaf and paid for by the raiser of cocoons.

The results of cocoons.—From actual local experience the produce of an acre of mulberry properly cultivated and planted, properly pruned and tended, should yield, with fair management, £15 to £25 per acre yearly, after a sufficient growth of the trees.

It might be mentioned in a casual way that owners of land, with sons and daughters especially, could with very slight outlay provide for each one severally by making plantations, even while they, the girls and boys, are growing up and the plantations at the same time also growing, and thus draw profit from their land additional to what it yields now—if indeed it yields anything at present. It should be noted that returns from silk-growing are less subject to fluctuation in demand, and less liable to disappointment from climatic causes than fruit or any agricultural produce now raised

in the Colony, not even excepting tobacco or grapes. Men and women would thus benefit themselves, greatly improve their properties, obtain a new crop for cash sale, endow a family with opportunity and means for employment which would exercise their thinking and administrative faculties, give them healthy attractive work on their own domains. Incidentally at the same time, by force of example, they would further fresh settlements and occupation of more land, and bring population to a neighbourhood where the industry may have been started.

The co-operative system, by which a grower of leaf and a labourer rearing worms for cocoons bargain to share results on terms agreed upon, is much in vogue in very many places. Often the party who grows the leaf also supplies the eggs (or better still, worms just hatched, or about to hatch) to be reared by a second party—a great mutual help to both parties, who must have confidence in each other. In Italy, where this method largely prevails, the whole of the cocoons as soon as completed are taken to the local "market," weighed by the "public weigher," and sold at the open market-rate, or by previous contract to some dealer at a fixed price, or more generally to a "filanda" or "reeling mill" for ready money.

In regard to silk-growing it may be remarked that in case of the proprietor of the trees raising his own cocoons by means chiefly or wholly by his or her own personal labour, or with assistance of the handiwork of members of the family, the whole or nearly the whole of the produce is profit, and profit without interfering with the growth of, or attention to, any other crop. The cash is certain and immediate, earned more quickly, generally with fewer disappointments, and realizable more readily than any other agricultural crop.

Some cocoons reared in Sydney, November, 1893, on inferior mulberry leaf (unpruned *multicaulis*):—"Empties," without floss or other matter, weighed net about 4 grains each cocoon. Sample cocoons arrived with graine, December, 1893, the gift of Signor A. Martelli, reared in Italy:—

8 cocoons, empties, with a little floss, weighed gross, including attached thread and label—variety, Bianco Indigeno, 26·6 grains.

10 cocoons, with less floss, weighed gross, including attached thread and label—variety, Gransasso, 58·8 grains.

11 cocoons, with some floss, weighed gross, including attached thread and label—variety, Fossombrone, 65·5 grains.

15 cocoons, with some floss, weighed gross, including attached thread and label—variety, Novi Ligure, 84·5 grains.

19 cocoons, clean and little floss, weighed gross, including attached thread and label—variety, Giallo Indigeno, 92·6 grains.

Average, 5·2 grains.

A lot of 8 cocoons reared in the County of Cumberland, by Signora Bolotti, November, 1893:—Empties clean and good, with floss as taken from the bush, with husk, &c., inside, averaged 6·74 grains.

The results thus shown are well up towards the standard gained for many years by Mr. Brady at Curl Curl and at Antony with different varieties of silkworms. They also correspond very fairly with the experiences of Mr. James Fry, Mr. George Thorne, Mrs. Hobbes, Miss Thorne, and Miss Ottmann, all in this Colony.

There can be no doubt that, with proper food and fair management, New South Wales may obtain and hold a foremost place in the production of silk in open competition with any part of the world, and certainly with results much better than now obtained in "cheap labour" countries.

The *Mark Lane Express* (London, 11th December, 1893) from its Paris correspondent says:—

"Owing to the favourable temperature of the spring (in France), and the care exercised in the selection of eggs, the results of the silkworm season have been very satisfactory. There were this year (1893) 148,971 breeders, against 141,487 in 1892, and these have hatched 225,012 ounces eggs, against 227,156 the preceding year. The production of new cocoons has been correspondingly larger, and prices have risen, not only for cocoons for weaving but for breeding."

The intention of the Government is that persons who earnestly desire instruction in silk-growing should, as far as practicable, have the opportunity of obtaining it from their appointed officer; and as this opportunity must necessarily be very limited at first, it is obvious that the demands for such instruction from persons possessing or actually forming plantations would have to be preferential.

Practical Vegetable Growing.

Directions for the Month of March.

During this month the heat of the sun is likely to diminish considerably, and some of the worst of the summer weeds lose vigour and become less troublesome. All rubbish, such as old useless vegetables, weeds, &c., should be cleaned up and either burnt or kept in a rubbish heap to rot and become useful manure. Whenever an opportunity presents itself, preparation should be made for new crops, and new ground can be put in order. It should be well and deeply dug and above all things well drained. If not sufficiently rich some cattle, sheep, or horse droppings should be well mixed with the soil as it is being dug up. This manure would be improved by being well rotted before it is used, one good reason being that most of the weed seeds that are almost certain to be in the dung will probably be destroyed. The rotting of the manure had better be done under some shelter, out of the rain, so that the best part of the manure cannot be washed away.

The latter part of the month of March is about the best time of the year to strike cuttings of ornamental flowering plants, such as roses, fuchsias, and others.

Asparagus.—It would be advisable to get a bed ready for some plants as soon as this can be done. The ground should be trenched 18 inches or 2 feet deep, some manure being well mixed up with the surface soil as it is being dug. It is not necessary to make a very large bed, for a few plants even will give an occasional dish, if the plants are looked after, and if the soil happens naturally to suit them the supply will be considerable. When the ground has been dug up the surface should be left as rough as possible until the time comes for planting in the very early spring. Asparagus likes a rich sandy deep soil, but it will grow fairly well in almost any kind of soil that has been well prepared. It is a native of the sea coast of Europe, and has been in cultivation from remote times and long before the Christian era. It is found growing wild in the sandy interior of Russia, far away from the sea coast, but probably the soil is saline. It should grow well in the inland parts of this Colony where the saltbush grows, and it will probably succeed splendidly where it could be irrigated by the water from artesian bores. At the present time nothing need be done beyond preparing the ground.

Bean, French or Kidney.—In the warm districts of the Colony a few rows should be sown, if the soil is not very dry. It will probably be too late to sow in the cold districts, for the plant cannot stand frost. Plants that have ceased to bear should be pulled up to make room for some other kind of vegetable. Old withered plants of beans or peas when allowed to remain give the vegetable garden a most miserable neglected appearance, besides taking up space that might be producing something useful. Every grower

of vegetables should strive to keep his garden tidy and make it worth looking at. If this be done the place will become more and more interesting and profitable.

Bean, Broad.—This vegetable has been in cultivation from the most remote times—thousands of years before the Christian era. The soil best suited to it is a heavy clay loam, although it will grow and bear well in almost any kind of soil. It would not be advisable to sow to any great extent during the present month. Dig the ground well, and if it is poor apply plenty of horse or cow dung, and if this has been well rotted, all the better. If artificial manure is used, apply little or no sulphate of ammonia or nitrate of soda. Use bone dust or superphosphate of lime and potash. Sow in rows from 2 feet to 3 feet apart, according to the variety, for the dwarf-growing kinds may be sown closer together than the tall. The seed should be sown about 4 or 5 inches apart in the rows.

Beet, Red.—Sow a row or two of this useful vegetable. Thin out well any plants that are coming up from previous sowings.

Beet, Silver.—Sow a little seed in ground that has been well manured, that is, if the soil is not naturally sufficiently rich without it.

Borecole or Kale.—It is doubtful whether this vegetable is worth troubling about when there are so many other kinds of the cabbage family can so easily be grown in the Colony. It will succeed best in the coolest districts. Seed may be sown in beds or boxes like cabbage, and the seedlings afterwards transplanted. It prefers a rather stiff soil, but may be grown successfully in almost any garden.

Broccoli.—Seed may be sown in the same way as cabbage seed, and the seedlings afterwards transplanted, bearing in mind the rule that the richer the soil the wider apart to plant. Plants available from previous sowing may be planted out.

Cabbage, *Brussels Sprouts*, *Cauliflower*, and *Savoy* may be planted out if well-grown seedlings are available. Seed also may be sown, and care should be taken not to sow it too thick in the drills.

Celery.—Sow a pinch or so of seed in order to have plants available when required. It should be remembered that celery requires a great deal of moisture during its growth, for its native localities are wet and marshy places. Plant out a few well-grown seedlings in well-manured ground. Make shallow trenches so that water and liquid manure when applied will not run to waste. It may be mentioned that although the plant requires plenty of water during its growth, it may be possible to over-water, whereby the result is a loss of flavour. The proper quantity to apply can only be learned by experience, and anyone who will take an interest in the gardening work will soon learn. The best manure to use for celery is the droppings of farm animals, mixed well with the soil when the ground is being prepared. If anyone wishes to try the common old method of growing and blanching this plant he should dig out trenches 12 inches deep or more and about 16 inches wide, the soil taken out of the trench to be spread along the top of the bank. At the bottom of the trench dig in a good supply of manure and plant strong stocky young seedlings 9 inches apart in the middle of the trench. The seedlings should be moved from the seed bed with care, and the roots injured as little as can be avoided. When the plants have attained a good growth they can be earthed up so as to make the stalks white, or "blanched" is the ordinary term used. The soil must not be allowed to drop into the centre of the leaves, or they will probably decay or become

injured and unfit for use. Some gardeners use paper round the stalks; but this is unnecessary if the stalks are held together, and care is taken when earthing-up is done.

Cress and Mustard.—Sow a little seed every now and then in a small, well-manured piece of ground. The plants will need water frequently when they come up, and subsequently.

Endive.—Seed may be sown in a seed bed or in boxes, and when the seedlings have grown large enough to handle they may be transplanted. This plant is best suited to a warm climate. Plant out about one foot or fifteen inches apart. When the plants are pretty well full grown the leaves should be tied together so that the inner ones may become white and tender.

Herbs.—Seeds of all kinds may be sown. These useful plants should not be forgotten. Sow in pots, boxes, or seed-beds and afterwards transplant. Parsley should be transplanted whilst it is very young, for it soon sends out a long tap-root, which had better not be broken.

Lettuce.—Sow seed in the seed-bed for future planting out. If any strong young lettuces are to be had plant them out in rich, well-dug ground. It is very often the custom to sow lettuce seed, at this season of the year, in rows where the plants are to grow, and not transplant, because the lettuces are very likely to run quickly to seed.

Leek.—This time of year is about the best season to sow seed largely of leeks. Prepare a seed-bed and sow in rows. When the plants are about 6 or 8 inches in height they may be transplanted to a bed made exceedingly rich with good farm-yard manure. Make shallow trenches and plant in rows about 18 inches apart, the leeks to stand about 9 inches from each other. Water and liquid manure will be needed often if it is desired to grow the best of plants.

Peas.—In cool, moist climates sow a few rows of this excellent vegetable. Prepare the ground well, and, if it is poor, apply a good deal of farm-yard manure.

Radish.—Sow a little seed occasionally to keep up a supply.

Sea Kale.—Sow a little seed in a seed-bed and afterwards transplant the seedlings, just as cabbages are planted, to well-manured, deeply-prepared ground; when the plants attain a good size they need to be covered and blanched, and for this purpose special kinds of pots are made, but dead leaves, manures with plenty of straw, boxes, or something to keep the light away from the plants, will answer.

Spinach.—Sow seed in drills in rich, rather moist, but well drained soil. Let the drills be about 18 inches apart, and when the seedlings appear, thin them out well. This is a very good vegetable and well worth growing.

Shallots and Garlic.—Plant out in drills about one foot apart as much of this useful vegetable as is likely to be required. The bulbs or cloves can be purchased from any seedsman. Dig the ground deep and manure it well. When planting just press the bulb firmly into the soil. Keep the plants free from weeds as they grow. *Garlic* may be planted out in the same way as the above, taking care to divide the bulbs.

NOTE.—The month of March is probably the best time of year to strike cuttings of plants for the flower garden. The ripe well-matured cuttings of roses will strike readily. This is a good time to sow seeds of annuals, which if raised now and planted out before the winter will flower very early in the spring.

Orchard Notes for March.

The notes which appeared in the last number of the *Gazette* for the month of February are generally applicable to March as well, especially as regards the care to be taken with the gathering, grading, packing, and marketing of the fruit, as the disposing of the fruit will constitute a large portion of the orchard work for the month. The bulk of the fruit to be marketed will consist of apples, pears, late peaches and plums, and passion-fruit. During the month the most of the later varieties of apples will be gathered in the coast district, and as they are not, as a rule, as good keepers as the same varieties grown in the colder parts of the Colony, they should be sold when gathered, being, however, allowed to thoroughly ripen on the trees. During this present season a large quantity of very unripe fruit—totally unfit for selling—has been sent to the Sydney markets, and, at the same time, there has been a large quantity of over-ripe fruit, which is often almost as worthless, as it will not stand handling. Until our fruit-growers learn what to pick, and how to pack it, and thoroughly realise the immense importance of sending their fruit to market in such a manner as to arrive in the best condition, and when opened to show to the best advantage, it will be impossible to obtain satisfactory prices; and it is very unfair for them to throw the whole blame of the unsatisfactory prices on the commission merchants when the fruit-growers are often the ones to be most blamed. Even in a glutted market, good fruit, arriving in good condition, has been fetching very satisfactory prices, whereas rubbish has been hard to get rid of at any price.

In the colder districts many of the mid-season apples and pears will be gathered, but it is not advisable to gather the late varieties for storing till they are thoroughly developed, as if gathered when immature they will shrivel with keeping, and will not develop their full flavour. With pears, however, this does not hold good, as no pear should be allowed to ripen on the tree. The exact state at which pears should be gathered varies with different varieties, but, generally speaking, it is when the pear is fully developed—has lost its woody taste—and has developed sufficient sugar to perfect its ripening when gathered. The exact state can only be learnt by actual experience, on account of the variation in the ripening of different varieties.

The codling moth will still require looking after, and the bands should be removed at least twice during the month, and the worms destroyed. After this month, however, it is not likely that any moths will hatch out for the season, so that the bands can be left on the trees till all the fruit has been gathered, when, being no more required for the season, they should be taken off and destroyed.

Keep the orchard clean during the month by the use of the cultivator. No one can afford to grow weeds in an orchard, as, besides forming a harbour for all kinds of insect and fungus pests, they are depriving the soil of the food required by the trees, and in a dry time every weed is a pump taking water out of the soil, which is often badly wanted by the tree itself, especially in badly-cultivated and undrained land.

General Notes.

The Disc Churn.

The remarkable results reported in English agricultural papers achieved by means of the "New Era" disc churn have been fully sustained at a trial which was held under the auspices of the Department of Agriculture on the 11th instant. Probably the most remarkable characteristic of this churn is the simplicity of its construction. It consists of a flat-sided box with a circular bottom. A multiplying gear is fitted outside the box, which works at great speed the only inside fitting—a plain wooden disc. The only covering is a narrow lid with rather deep projecting sides just covering the disc as with a hood, and there being openings in either side of this cover the entire process can be watched by the person working the churn. The cream, being of a sticky nature, adheres to the disc, which being revolved at great speed dashes the cream into the hood and against the sides of the churn. This perfectly aërates the cream, and the churn being open at the top all bad gases escape at once instead of being re-churned into the butter. When the cream gets quite thick and the butter globules are almost ready to break, a little water is added by means of a syringe, which washes out the corners and sides of the churn, so that the whole of the cream comes into the churning operation. When the butter breaks, more cold water is added, and a few turns of the handle are given. The buttermilk is turned off by simply removing a wooden plug from the lowest point of one side of the churn, the plug being then replaced and the churn filled with cold water, according to the judgment of the operator. About two minutes' fast churning in both directions is given; the water is then thrown off, and the butter is then ready for brining, which is accomplished in the same manner as the washing. The hood is then removed and swilled out with cold water, the churn is filled up with cold water, which is then drawn off, and the butter is removed with a scoop. Then follows one of the most interesting portions of the operation:—The butter which was removed from the churn is placed in a utensil called a dryer. This consists of a drum with perforated zinc sides lined with butter-cloth and wooden top and bottom, one removable. This drum fits on to the axle from which the disc is removed, and is whirled rapidly by means of the same gear until moisture ceases to fly off. The dryer is then removed from the churn, and the butter, with the grains intact, is ready to be made into pats for sale without any further working.

On the occasion above referred to two trials were made in the presence of Mr. W. S. Campbell and several officers of the Department of Agriculture, Mr. Angus Mackay, of the Technical Education Branch, and several Press representatives. The site of the operations was in the rear of the

offices of the Department of Agriculture in Macquarie-street, the churn being fitted up under a corrugated-iron shed, where the temperature ranged from 87 to 92 degrees (F.) Two tests were carried out. The first was with 8 quarts of cream (the quantity for which the churn used was intended), at a temperature of 72 degrees. The butter came in 2½ minutes. This was not put into the dryer, owing to its being somewhat overchurned. In the second test nearly 10 quarts of cream were used. This was put in the churn at a temperature of 55 degrees, and the butter, which was rather longer in coming, came at 66 degrees. It was a mass of golden globules, and broke with a perfect grain. On being removed from the churn it was placed in the dryer, and within 15 minutes was turned with texture and grain unimpaired and ready to be made into pats for sale. It is not considered necessary to expatiate upon these facts, which speak for themselves; and Messrs. Lassetter & Co. are to be congratulated on their promptness to secure the Australian agency for this valuable improvement in butter-making appliances.

A Simple and Efficacious Codling-moth Trap.

At a recent meeting of the Pomological Committee of the Department of Agriculture a very simple and efficacious codling-moth trap was submitted by Mr. Morgan, of Goulburn, one of the members of the Committee, and was very favourably commented upon. The trap consists of two pieces of ¾-inch deal, about 4 inches broad and 16 to 18 inches long, hinged together at one end with a strip of zinc, so as to allow the two pieces to be folded together or opened easily. A piece of thick brown paper is placed between the two pieces of board, which are then tied together by a piece of string at the unhinged ends. The trap is now ready for use, and is stood at the foot of the tree, care being taken that all other shelter in the shape of loose bark, &c., is first carefully removed, when all the larvæ of the moth, when fully developed and looking for a place in which to pupate, will take refuge between the boards of the trap, and they may then be easily destroyed. From one of the traps exhibited Mr. Morgan has taken this season as many as eighty larvæ of the moth in three days, and when opened before the meeting the two traps must have contained fully 100 fully-developed larvæ. An improvement in the trap was suggested by replacing the zinc hinges by leather ones. The easiest way to destroy the larvæ caught in the traps is to place the traps bodily in boiling water. The larvæ should not be crushed and allowed to remain in the trap, as, if so, the traps will become surfeited with small ants, which will prevent any more larvæ from taking shelter in the trap. The traps should be examined every three to five days.

The Tobacco Trade.

In view of the recommendations by Departmental experts that New South Wales tobacco-growers should look to the European markets, the annexed table of current prices in London is extracted from the *Tobacco Trade Review*, of 1st November, 1893. This, of course, shows the trade actually done, and may therefore be taken as a fair indication of what growers may expect to realise for suitable leaf, freight, &c., being duly allowed for.

PRICE CURRENT.

London, 31 October, 1893.

THE following prices are quoted subject to duty, and are from the latest actual market sales :—

	Prices this day.	Prices at the same period of 1892.
	s. d. s. d.	s. d. s. d.
Virginia leaf, ordinary and faded ... part dark and sweet... fine dark and sweet ... ordinary sound ... middling ... ... fine and spinning ...	0 6 to 1 3	0 4 to 1 2
fine bright	0 10 ,, 1 3	0 8½ ,, 1 4
Virginia stemmed, ordinary faded ... common (short).. middling ...	0 6 ,, 0 10	0 6 ,, 0 10
fine	0 11 ,, 1 1	1 0 ,, 1 4
Western leaf, ordinary ... ... middling	0 4 ,, 0 7	0 4 ,, 0 7
fine	0 7½ ,, 0 10	0 7½ ,, 0 10
Western stemmed, common ... ... middling... ...	0 4½ ,, 0 8	0 5 ,, 0 8
fine	0 8 ,, 0 10	0 9 ,, 0 10
Ohio leaf, scrubs	0 4 ,, 0 7½	0 5 ,, 0 7½
leafy brown	0 8 ,, 0 10	0 8 ,, 0 10
coloury and leafy...	0 10 ,, 0 11	0 10 ,, 0 11
yellow	0 11½ ,, 1 1	0 11½ ,, 1 1
Columbian and Ambalema	0 2 ,, 2 0	0 2 ,, 2 0
Dutch and German	0 4 ,, 1 4	0 4 ,, 1 4
Esmeralda	0 10 ,, 1 6	0 10 ,, 2 0
Sumatra	1 0 ,, 6 6	1 0 ,, 4 0
Turkey	0 5 ,, 0 9	0 5 ,, 0 9
Greek	0 3 ,, 0 5	0 3 ,, 0 5
Negrohead and Cavendish	0 7½ ,, 1 4	0 7½ ,, 1 4
Havana	1 4 ,, 3 0	1 4 ,, 0 0
Cuba and Yara...	1 0 ,, 2 0	1 0 ,, 2 0
Algerian	0 0 ,, 0 0	0 0 ,, 0 0
Java	0 5 ,, 0 9	0 5 ,, 0 8
China	0 3½ ,, 0 7	0 4 ,, 0 6½
Japan	0 6 ,, 0 8½	0 5 ,, 0 6
Japan Cigar	0 5 ,, 0 6	0 6½ ,, 0 10
Seed leaf	0 4 ,, 1 1	0 4 ,, 1 1
Manilla leaf	0 9 ,, 3 0	0 9 ,, 3 0
Mexican	0 7 ,, 5 0	0 7 ,, 5 0
Paraguay	0 3 ,, 0 0	0 3 ,, 0 0
Stalks, duty paid	0 0 ,, 0 0	0 0 ,, 0 0
Smalls	0 0 ,, 0 0	0 0 ,, 0 0
Havana Cigars	8 0 ,, 40 0	8 0 ,, 40 0
Manilla Cigars and Cheroots	4 0 ,, 6 6	4 0 ,, 6 6

DUTIES.

Tobacco Manufactured, viz. :—

Cigars	the lb. 5s.
Cigarettes	the lb. 4s.
Cavendish or negrohead	the lb. 4s. 6d.
Cavendish or negrohead manufactured in bond	the lb. 4s.
Other manufactured tobacco	the lb. 4s.
Snuff containing more than 13 lb. of moisture in every 100 lb. weight thereof	the lb. 3s. 9d.
Snuff not containing more than 13 lb. of moisture in every 100 lb. weight thereof	the lb. 4s. 6d.

Tobacco Unmanufactured, viz. :—	
Containing 10 lb. or more of moisture in every 100 lb. weight thereof	the lb. 3s. 2d.
Containing less than 10 lb. of moisture in every 100 lb. weight thereof	the lb. 3s. 6d.

The American tobaccoes are those which commence the list, as far down as "Ohio leaf, yellow," the range being from dark to bright. White Burley and Yellow Prior, seeds of which have been distributed by the Department, are the sorts from which "bright" tobaccoes are hoped to be derived. While on the subject of prices it is interesting to note that 7½d. per lb. has recently been obtained in Sydney for Tumut leaf, which is not actually superior to the ordinary bulk of Tumut tobacco, except as regards sorting and preparation for market.

AGRICULTURAL SOCIETIES SHOWS, 1894.

Society.	Secretary.	Date.
Wollongong Agricultural Society	J. A. Beatson ...	Jan. 31, Feb. 1.
Berry A. and H. Society	A. J. Colley ...	Feb. 6, 7, 8.
Gosford A. H. and I. Association...	H. S. Berenge ...	,, 9, 10.
Luddenham A. and H. Association	K. Campbell ...	,, 13, 14.
Manning River (Taree) A. and H. Association ...	W. Plummer ...	,, 14, 15.
Shoalhaven A. and H. Association	R. Leeming ...	,, 15, 16.
Lithgow A. H. and P. Society	Dr. M. Asher ...	,, 15, 16.
Tumut A. and P. Association	W. H. Bridle ...	,, 27, 28.
Marulan P. A. H. and I. Society	H. Morice ...	,, 23.
Kangaroo Valley A. and H. Society	H. Joyce	,, 25, 26.
Candelo Agricultural Association	C. H. Brooks ...	,, 27, 28.
Tenterfield P. and A. Society	J. Harker ...	,, 27, 28, Mar. 1.
Port Macquarie Agricultural Society	A. E. Pountner ...	,, 28, Mar. 1.
Lismore Agricultural Society	C. S. Connor ...	,, 28, Mar. 1, 2.
Berrima District (Moss Vale) A. H. and I. Society	James Yeo ...	Mar. 1, 2, 3.
Nepean District A. H. and I. Society	A. Baker	,, 1, 2, 3.
Bega A. P. and H. Society...	A. P. Wilson ...	,, 7, 8.
Upper Murray and Tumberumba P. and A. Association	W. Willans ...	,, 13, 14.
Armidale (New England) A. and P. Association ...	W. H. Allingham	,, 20, 21, 23.
The Royal Agricultural Society of New South Wales	F. Webster ...	,, 21 to 27.
Castle Hill A. and H. Society	F. H. G. Rogers...	,, 26, 27.
Walcha P. and A. Association	H. Chapman ...	April 4, 5.
Gundagai P. and A. Society	W. E. Kyle ...	,, 5, 6.
Namoi P. A. and H. Association	T. Riddle... ...	,, 11, 12.
Dubbo P. A. and H. Association	G. H. Taylor ...	,, 24, 25, 26.
Warialda P. and A. Association	W. B. Geddes ...	,, 26, 27.
Mudgee Agricultural Society	J. M. Cox ...	,, 26, 27.
Macleay (Kempsey) A. and H. Association ...	H. R. Gray ...	May 9, 10, 11.
Upper Manning (Wingham) A. and H. Society...	P. Doust	,, 16, 17, 18.
Forbes P. A. and H. Association	W. G. Dowling ...	Aug. 9, 10.
Northern (Singleton) Agricultural Association ...	C. Poppenhagen ...	,, 15, 16.

N.B.—Secretaries will greatly oblige by giving the Department early intimation of the dates fixed for Shows.

[2 plates.]

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Acacia melanoxylon, R. Br.

"Blackwood or Mudgerabah."

Useful Australian Plants.

By J. H. MAIDEN,
Consulting Botanist.

No. 7.—The Blackwood or Mudgerabah.

(*Acacia melanoxylon*, R. Br.)

Other Vernacular Names.—It is called "blackwood" on account of the very dark colour of the mature wood. In Captain P. P. King's work, Allan Cunningham refers to it as the "blackhearted wattle" or "native ash." It is also called "lightwood" in Tasmania, Victoria, and southern New South Wales, but the origin of the term, even amongst many people who use it, is not always clear. An explanation often given is that since the great majority of the useful timbers of Australia and Tasmania are heavy, the name is simply to draw attention to its comparative weight. This explanation is, however, untenable. The blackwood has rather a wide sapwood, up to 4 inches, and this is very light in colour—almost white; so that, on removing the bark from a blackwood, a man would at once come across this very light-coloured wood, hence the name "lightwood"; and this is how a good many people explain it. I think, however, the explanation simply is that pale-coloured blackwood is called lightwood. A blackwood which has grown rapidly has often timber paler in colour and more porous than the standard blackwood, and would be called lightwood. Anyhow the fact remains that blackwood and lightwood are absolutely identical from the botanical standpoint, and differ only on account of differences in soil and climate. While on the subject of the pale sapwood, years ago, an old man in the Braidwood district displayed great skill in cutting it into very thin strips, which he used to fashion into baskets of various kinds, and these had a ready sale. The old man's knife was made of hoop-iron, and no one seemed to be able to imitate him in making such excellent basket material. The species has also been sent as "bastard myall" from Port Stephens and Glen Innes, and as hickory from the southern parts of this Colony. It probably bears other local names. North of the Clyde River people are ignorant of the identity of the tree with the blackwood of Tasmania and Victoria, and hence do not employ that term to designate it.

Aboriginal Names.—"Mootchong" of the Ja-jow-er-ong tribe, Victoria, and Mooeyang or Moeyang of the Yarra blacks. "Mudgerabah" is an old aboriginal name in northern New South Wales, and is the name by which the tree is generally known, at the present day, in New England.

Botanical name.—*Acacia*, from *ac*, a point (Celtic), or *akazo*, I sharpen, (Greek), as many of the species are furnished with spines. Spines are, however, the exception in Australian species. *Melanoxylon;* this is from two Greek works signifying "black wood," and Robert Brown, the botanist, who adopted this designation, simply translated the commonly accepted colonial name.

A

Exudation.—Many of our *Acacias* yield gums, but I have never seen gum on a blackwood, although I have carefully looked for it in different parts of New South Wales and Victoria, and upon trees growing under widely different circumstances.

Bark.—The bark of this valuable timber-tree has usually gone to waste after the wood has been obtained from the logs. Baron Mueller says: "The bark is, however, rich in tannic acid, and ought not to be left unutilized, though no trees of this species should be sacrificed for their bark alone." This may be true as regards Victorian trees, but I have not seen any New South Wales blackwood barks of much value. One from an oldish tree from Monga, near Braidwood, yielded 11·12 per cent. of tannic acid, and 20·63 per cent. of extract. This is the only specimen I have subjected to chemical analysis, but I have roughly tested other barks of the same species, and am inclined to think that blackwood bark is very inferior for the purposes of the tanner.

Timber.—This is considered by some people to be the most valuable of Australian timbers. Perhaps this is a bold claim to make, bearing in mind the high merits of such timbers as ironbark and red cedar, but it is undoubtedly a timber of the highest class, happily combining an ornamental character with great strength. It is hard and close-grained, and is much valued for furniture, billiard-tables, cabinet-work, picture-frames, gun-stocks, walking-sticks, crutches, tool-handles, railway and other carriages, boat-building (stem and stern-posts, ribs, rudder), naves of wheels, parts of organs, piano-fortes (sound-boards and actions), and many other purposes too numerous to individualise. Blackwood is strikingly like American walnut in most respects, in fact the former is probably often substituted for the latter without the purchaser being any the wiser, the incentive being that walnut brings about a shilling a foot, and blackwood about a fourth of that price in the Sydney market. If blackwood be treated with lime water or potash, the deception will be complete. Blackwood is pushing itself forward on its own merits, but it has to fight against a good deal of the prejudice which is shown to colonial timbers, largely caused by unseasoned timber having so often been supplied. The similarities of walnut and blackwood are not confined to outward appearance, for their properties appear much the same. Hence a knowledge of the many uses to which the former timber is put is useful as a guide to the capabilities of our blackwood. A good deal of it possesses a "broken grain" and satiny lustre which are exceedingly ornamental. Nothing, in my opinion, resembles the figure of picked samples so strongly as the South African mineral crocidolite, which, as is well known, has a characteristic and beautiful appearance. The figured wood is cut into veneers. It takes a fine polish. It is an excellent wood for bending under steam. It requires fair play in the matter of seasoning, and will well repay any reasonable care expended on it. A drawback to this valuable timber is that it does not take the glue as well as many others. Rosewood behaves similarly to glue; I do not know the reason of this, it may be from the presence of oil-cells. It was largely used for oil-casks, chiefly for the Hobart whaling trade. The lightwood was chiefly used for this purpose. As regards its use for wine-casks, Mr. Thomas Hardy, of Adelaide, has pointed out that this timber is open to the objection that it leaks through the pores when sawn, but it is tight when split on the quarter. As a charcoal wood, its charcoal burns with intense heat, but almost as fast without blowing as it does with, which is of course objected to by blacksmiths. Blackwood is not proof against white ants. Its specific

gravity, according to Baron von Mueller, is from ·664 to ·777, *i.e.*, the weight of a cubic foot of the dry timber varies between 41 and 48 lb. Mr. Gamble gives the weight per cubic foot of an Indian grown specimen at 36 lb., and states that it was cut from a tree twenty years old, and 90 feet high, which gave a plank 2 feet broad; but in India it appears to lack density and deteriorates in value. It is a wood much appreciated by the Victorian blacks. For instance, the Yarra blacks used to make their mulgas or club-shields of it, their throwing sticks (for propelling spears), and their "lil lil," a curved fighting weapon with a knob. Following is a report by Mr. Allen Ransome on some samples of this timber sent from Victoria to the Colonial and Indian Exhibition:—"Samples of both old and young trees were sent for trial. The former were made into joiners' specimens, the latter into casks. The figure of the old-growth wood is very fine, and the surface left by the cutters was all that could be desired. The casks proved a complete success. The wood has already been imported into England in small quantities, and sold at prices from 2s. to 3s. per cubic foot." I quote descriptions of Tasmanian wood by the same authority, as, since we look forward to an increasing trade in colonial timbers with the United Kingdom and the Continent of Europe, a report by a well-known English expert has peculiar value.

"*Blackwood.*—A sound, mild working timber of a brownish colour, closely striped with streaks of various shades of reddish-brown, and frequently crossed by diagonal marks of a light golden colour. The more ornamental logs of this wood are exceedingly beautiful, and should fetch a high price in this (London) market, where they could be used to advantage in place of the best Honduras mahogany, while the less ornamental logs would serve for the higher class of joinery work, such as counter and shop fittings. The younger growth is well suited for cooperage work, and a barrel made from one of the pieces submitted for trial, before being artificially seasoned, is still quite tight, and shows no sign of shrinkage.

"*Lightwood.*—This is an inferior description of blackwood, from which it differs mainly in being of a lighter colour, and having a somewhat more open grain. Although it will not compete with the blackwood for highly ornamental cabinet work, it can be used in the place of cheap mahogany for wardrobe backs and other similar work."

It will be observed that most of the reports on the utility of this timber refer to Tasmanian and Victorian wood. This is because the occurrence of blackwood in New South Wales is known to very few people, whereas, as is stated in the proper place, it is very widely distributed in this Colony, although usually looked upon as some other timber. In sending a New South Wales specimen for identification, Mr. Van Weenen, of Gunnedah, writes to the Department:—"It is only lately that it has been brought to the saw-mills at Boggabri, and the sawyers do not know it. It grows in this district, and is being used by coachmakers and cabinet-makers, who speak very highly of it." Neither do the saw-millers in the Richmond River district know anything about it. There it is chiefly cedar, pine, hardwood, the changes being rung on these three indefinitely. Beyond these, little is locally known of colonial timbers. Strange to say, that while the timber is highly spoken of in the southern localities of New South Wales I have mentioned below, it is hardly ever used. Now this does not indicate that it is of little value, as some cynics who delight to sneer at native timbers infer, but simply that the public in the district are not yet alive to its value, and shippers are ignorant of its

occurrence in the particular locality. In a sparsely populated district the local demand for even a popular timber will be readily satisfied, but when we consider the case of a little known timber, users are timid about giving an order for something of whose value they are at present ignorant. Still, even in the southern districts it is worked up to some extent, and it only requires that our people shall be informed that they have growing near them the true blackwood for them to use it a good deal more. I know of a Braidwood tradesman who has made, for many years, articles of the local blackwood. His work has a deservedly good reputation, and he does not make chests of drawers, secretaires, plate-chests, &c., out of a timber of whose value he has any doubt. I know of another tradesman at Delegate who used to make beautiful gun-stocks of it. The price he gets for his gun-stocks is so high that I am afraid to mention it, as everybody may turn to gun-stock making. Another tradesman uses it for buggy naves. He from time to time goes out and cuts down a fair-sized tree, lets it season outside in the log, and cuts length by length off as he wants it.

The manufacture of gun-stocks from this timber is a very old industry, particularly in Tasmania. I find that in the season 1844-5 that 430 gun-stocks were exported from Launceston to Great Britain.

A number of tests have been made in regard to the strength of blackwood, but as it is unsatisfactory to make an abstract of experiments of this kind, I give a list of the most important of them, in order that architects, engineers, and others interested may readily refer to the originals:—

1. Tests of the timber experimented upon by the Victoria Timber Board, Railway Workshops, Newport, Melbourne, 1884.
2. Experiments on the tensile strength of a few of the colonial timbers. F. A. Campbell, in Proc. Roy. Soc., Vict., 1879, p. 6.
3. Experiments on the transverse strength of the wood of *Acacia melanoxylon*, by Baron Mueller and J. G. Luehmann; Cat. Timbers, Tech. Museum, Melbourne, 1885.
4. Australian Timbers; by Professor Warren. An exhaustive series of tests published under the auspices of the N.S.W. Commission for the Chicago Exhibition, 1893.

The Mudgerabah as a Shelter-tree.—The traveller in New England cannot fail to notice a symmetrical, umbrageous tree, usually some 40 or 50 feet in height, with a trunk-diameter of 2 or 3 feet, and with a great spread of leafy branches. It has rough bark, and its leaves remind some country people of "some sort of a gum-tree." When in flower or seed it will be noticed to be a wattle. It is found a few miles from the coast, at an elevation of about 2,500 feet above sea-level, and I noticed it all over the New England country, even at Guy Fawkes, the summit of the Snowy Range, and the highest point of New England. The climate here is very severe, yet the trees of this Acacia are magnificent specimens, showing how hardy it is. It is everywhere called Mudgerabah, and it is about the only tree that pastoralists do not ringbark, as it gives a grateful shelter to the stock during the summer, while, in those districts where frosts occur, the cattle are found under it during the coldest nights, as the frost cannot penetrate the dense foliage. From the æsthetic point of view, it is desirable that these trees should be conserved, for they are charming objects in the landscape, many of them being as nearly symmetrical as it is possible for a tree to be. This tree is none other than the blackwood. From the point of view of the timber-getter, the trunks of the Mudgerabah are usually too short, but if it be necessary to fell one, the timber deserves a better fate than to be utilized as fuel.

Size.—In the southern mountain districts, there are many trees 70 or 80 feet in height, with a stem diameter of 2 or 3 feet. The Mudgerabah, which may be taken as a type of the northern New South Wales form, is usually 40 to 50 feet high, and also has a diameter of 2 or 3 feet. In Tasmania and Victoria, it is as large and larger than those in the southern mountain districts of New South Wales.

Distribution.—The blackwood is best known as a Tasmanian and Victorian tree, but it is extensively distributed in the southern mountainous districts of New South Wales. It then seems to skip over the immediate neighbourhood of Sydney, but reappears in the rising country at the back of Port Stephens, and is extensively distributed in the tableland of New England, extending into Queensland. From Port Stephens to Queensland it is frequently found wherever the elevation is not less than 2,500 feet. What its precise western boundary is we do not know at present, but I have seen it from Tenterfield, Glen Innes, Boggabri, and near Armidale. It occurs abundantly in the Mudgee District. It is plentiful in the Richmond River District, occurring in places at no great elevation, and at no great distance from the sea. As far as southern New South Wales and Gippsland are concerned, the blackwood must be considered as a mountain species, though it occurs occasionally in the low coast land, but there it never attains any size. It varies a good deal in mode of growth, according to situation and geological formation. In the rich humus of the jungle of the mountain slopes, it attains a height of from 60 to 80 feet, and in Gippsland, along the boundary of New South Wales and Victoria, localities may be found where it attains a height of 120 feet, and a diameter of nearly 3 feet. There, straight trunks may be seen without a limb, from 60 to 80 feet, the timber quite sound, and possessing that beautiful dark colour whence the species has derived its popular as well as its scientific name. When it grows on high mountains, as on the Delegate and Tingiringi Mountains, amongst rocks and precipices, it grows very gnarled and spreading, from 20 to 40 feet high, and from 1 to 2 feet in diameter, sending out thick, long, gnarled, and crooked limbs quite close to the ground. Mr. W. Bäuerlen tells me that on the Delegate Mountain he has seen them as low as 1 foot from the ground, with the limbs of great length, and eventually touching the ground. Those trees furnish most beautiful timber, as far as grain and figure are concerned, but generally not quite so dark as the timber growing in the rich soil, but the situations are mostly inaccessible to vehicles of any kind. As regards the southern part of the Colony, the Clyde Mountains, Braidwood, and the Bateman's Bay District, may be considered the most northern localities in New South Wales for blackwood of commercial sizes. From thence, it can be obtained all along the coast range right down to the southern boundary, where, as has been already stated, it attains its greatest luxuriance in the brush country, in common with sassafras, musk, and other well-known plants. On the mountains east of Bombala, Nimitybelle, and Cooma, but yet on the high tableland, there is a belt of forest fringing the Monaro Plains. This forest, where it is intersected by its numerous creeks, valleys and gullies, should furnish a plentiful supply of blackwood. It has been but imperfectly prospected for that valuable timber, yet plenty of trees 2 feet and more in diameter have been seen, with trunks furnishing logs from 20 to 40 feet in length. This is a favourable locality, since carriers go from thence to the Cooma railway station on the west side, and to the seaports of Merimbula and Twofold Bay on the other. The eastern mountain slopes near Candelo, Colombo, Bega, Cobargo, Tilba Tilba (Dromedary), and Moruya, contain also a large supply of this timber.

Propagation.—From seed, which is readily purchasable. I recommend this valuable tree to be conserved and planted in the cooler, moist districts of the Colony, *i.e.*, in the coastal and dividing-ranges and table-lands. It is also a shady, ornamental tree, and hence is often cultivated in Sydney gardens. With me, it has grown 20 feet high in three years—healthy, thick foliaged trees. This tree has been extensively cultivated in Madras for revenue purposes, but the wood has been found to possess there few qualities prized by the cabinet-maker and builder. It warps after many months of seasoning, is not easily worked, and is not as durable as other timber accessible to the residents of the hill stations. The slowness of growth is much against the tree, and where it has been tried, in two instances, as an avenue tree, it has proved a failure. It is liable to attacks from a mistletoe. As a fuel tree it is not prized so highly as *A. dealbata* (Silver Wattle). The blackwood was introduced on the Nilgiris in 1840, and is now completely naturalised. It is also being grown on the hills of the Punjaub, Kumaun, and Sikkim, in India. I am not surprised at the want of success with this tree in tropical countries.

References to plate.—Acacia melanoxylon—1. Leaf (phyllode) from Ballina, N.S.W.; 2. Leaf (phyllode) from Hobart, Tasmania; 3. Flower-bud (largely magnified); 4. Individual flower (largely magnified); 5. Ripe pod (without seeds), less than natural size; 6. Seed, showing funicle twice encircling it, about natural size.

No. 8.—A Spear or Corkscrew Grass.

(*Stipa setacea*, R. Br.)

Vernacular name.—Owing to the spear-shaped ripened seed, to which is attached a long awn. Called "Corkscrew Grass," owing to the twisted, corkscrew-like appearance of the lower part of the awn.

Botanical name.—*Stipa setacea* R. Br. *Stipa*, Latin for "tow," in allusion to the feathery awns of the original species (*S. pennata*). In our species the awn is naked. *Setacea*, bristly, in allusion to the fine leaves. *S. setacea* is found pretty well all over Australia, and hence it is not surprising that it varies a good deal. For instance, the leaves vary in width, and also in length, and we have figured both narrow and broad-leaved forms.

The genus *Stipa* contains about 100 species. Australia claims fifteen, New Zealand two, one* of which is also found in Australia, while the others are natives of America and Asia. The United States has twenty-three species, and some of these have well marked varieties. In that country they are not, at least at present, accounted of much importance to the grazier, and no experiments appear to have been undertaken to determine their specific fodder value.

Botanical description (*Flora Australiensis*, vol. vii, p. 568) :—

Stems.—Slender, 1 to 2 feet high, or rarely more.
Leaves.—Fine and short, tufted at the base of the stem. Those on the stem few, with long sheaths.
Ligula.—Elongated, not ciliate; often broken off from dried specimens.
Panicle.—Loose, 4 to 10 in. long; glabrous.
Outer glumes.—Very thin, narrow, acuminate; 4 to 5 lines long.
Flowering glume.—Much shorter; pubescent or villous; entire at the top.
Awn.—Glabrous; very fine; 1½ to above 2 in. long.
Palea.—As long as the glume; often hardened when ripe.

* Two, if *S. petriei* be reducible to *S. setacea*.

The wide diffusion and variability of this grass have already been alluded to. In some forms the panicle is much looser than shown in our drawing; in others, the amount of twist ("corkscrewness") of the awn varies, and other points of variation might be mentioned.

Size and habit.—An erect growing grass, attaining a height of 2 feet and more. When old the stems are sometimes almost cane-like, and the roots almost bulbous.

Value as fodder.—Although this is a rather coarse grass, it is useful on account of its drought-resisting qualities; it is much relished by stock of all kinds, and is very nutritious while young and tender. Mr. Bacchus says of it: "By reason of its early growth of nice tender herbage, which stock are fond of, it constitutes a useful part of the supply of early annual grasses." There is no doubt at all that it is a really valuable grass before the "seeds" ("spears") ripen, and hence it is admissible into the category of "useful plants," but a sad drawback to its value is the danger to sheep and wool from these seeds. They are produced in large quantities, are caught up by the wool, and by the mouth and nostrils. The structure of the "seeds" is sufficiently shown in the drawing, and they work home as certainly as a corkscrew or a gimlet. Mr. Bacchus says: "I once lost 800 out of 2,000 lambs by placing them on a part of the run which had been rested for some time where this grass abounded, and was just beginning to shed its seeds, which penetrated the skin in hundreds; and, but for being able to get them shorn at once, I believe nearly all the lambs would have died." Mr. Alfred Hawkesworth, who has had a good deal of experience in such matters, has been kind enough to give me the following note on the terrible havoc spear-grass sometimes works with sheep:—"Of all grasses and weeds, spear-grass seeds are the most damaging to sheep and wool. Being straight, and with sharp-pointed ends, when once they get attached to the wool they lie parallel with the staple and fibres, and by the movement of the animal they work their way on to the skin. In extreme cases the fleece is composed of fully 75 per cent. of spear-grass seeds, so persistently do they hold on to the wool. When once they get a hold, they never fall out. In the same way, when these sharp-pointed seeds enter the skin, they work through it, right into the sheep, until they come in contact with the vital organs, which results in certain death. I have seen them in the heart of a sheep, and even having a hold on the bones, from which they could not be pulled; they would break off. I once saw a mob of sheep that had travelled from Hughenden to Townsville (Queensland), where they were slaughtered, and the spear-grass seeds were so dense and tenacious that they had to be cut through, in order that the skins might be released; also, all through the body, to the intestines and lungs, they were present in large quantities. The face, also, suffers greatly, making the sheep blind in a very short time. I am of opinion that spear-grass country is only fit for cattle." This bad character must not be borne entirely by *S. setacea*, as some other Australian species of *Stipa* contribute to this result, and the blame must be borne by them jointly. Spear-grasses are also credited with destroying a large number of young chickens.

Stipa spartea is also injurious to sheep in Manitoba, Canada. Mr. R. M. Christy observes (*Proc. Linn. Soc.* 1883-6, p. 57):—"This wide-spread species forms a more succulent grass than any other of the prairie grasses, and is locally known as buffalo-grass, spear-oat, &c. The fruits ripen in July, and the awns penetrate the hides of sheep and dogs, causing much damage to the settlers. They are very like those of *S. pennata*, but about ⅞-inch in length, with an awn nearly 2 inches long, twisted nine or ten times. Rather more

than 3 inches beyond, it is produced into a delicate bristle, which does not twist, and many small teeth pointing upward; when wet, the whole awn is perfectly straight. The author experimented in August, November, and December upon *S. spartea* and *S. pennata*, and found that actual penetrative power was possessed by the hygrometric awned seeds. Butchers repeatedly find these seeds embedded about half an inch beneath the skin of animals slaughtered by them, and animals have not infrequently to be destroyed on account of their being infested with these fruits."

Other uses.—Nil. This and other species have toughish stems when old, but none of them approach the Esparto (*S. tenacissima*), in this respect.

Habitat and range.—Found in every one of the colonies, from the coastal districts to the deserts of the centre of the continent.

References to plate.—*Stipa setacea*—1. The long ligule; 2. Spikelet (opened out a little); 3. Outer or empty glumes; 4. One empty glume, showing venation; 5. Flowering glume, with awn; 6. Flowering glume, entire at top. All variously magnified. A, filiform leaves (type form); B, an old plant from western New South Wales.

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Stipa setacea, R. Br.

"A Spear Grass or Corkscrew Grass."

Walking-sticks and Umbrella-handles from New South Wales.

By J. H. MAIDEN.

A COUPLE of years ago I issued the circular referred to below to personal friends and correspondents. I received a number of valuable replies in consequence. Through the pages of the *Gazette* I am enabled to appeal to a wider audience, and I beg to bring the subject under the notice of its readers.

Walking-sticks, canes, umbrella-handles, &c., of one sort or another are always in demand. At present, although we import a very large number of finished sticks, our quota to the world's supply of raw sticks is mainly limited to a few Mitchenbills* or Walking-stick Palms (*Kentia monostachya*). It is a matter of everyday remark that sticks of a useful or ornamental character are noticed in the bush, and are either passed by or cut down for temporary use and then cast away. But in the ornamental or curiously-shaped sticks that we so often see in the bush, I see a prospective minor industry. The collecting of sticks is not going to rival gold-mining, but the accumulation of them at odd times (like the gathering of certain gums and resins), will be remunerative as soon as our people have learnt how and what to collect. Sticks of the kind required will not take up much room, nor are they objectionable in any way. If each family in the bush can make just a few pounds a year out of sticks, it will be with no interference with the ordinary duties of each member; but it will only lead to disappointment if sticks be gathered without reference to what will probably be required, and therefore the hints which follow are commended to careful consideration.

[CIRCULAR.]

I am collecting information in regard to the suitability and availableness of Australian saplings and timbers for walking-sticks, umbrella and parasol handles, and I shall be grateful if you will help me in the inquiry.

I have jotted down the following general notes *re* walking-sticks. They should possess :—

(*a*) Rigidity.
(*b*) Strength.
(*c*) A good root or excrescence to form a handle.

Weight is not material. Straightness is not absolutely essential, as any sticks can be straightened by suitable processes. They should taper to the end. There should be facilities for collection and shipping, as they would require to be delivered at the port of shipment at a very low rate.

Sticks are of two kinds :—

1. **Those cut out from the solid, *e.g.*, Forest Oak, Native Pear, Blackwood, Red Ironbark, and the outer portion of the stem of the Cabbage Palm.**
2. **Saplings, such as Tea-trees, Wattles, small Palms, and innumerable others. It is to this class that we should mainly look for suitable sticks.**

There are innumerable kinds of suitable saplings to be obtained, and they might be procured at odd times by children and others, kept until a fair number accumulate, and then disposed of.

Peculiar sticks, such as saplings with twiners round them, are desirable.

* *Vide* note, p. 138.

In the course of this inquiry I put myself into communication with Messrs. Henry Howell & Co., cane and stick manufacturers, of 180, Old-street, London, E.C., who are well known to be far and away the largest firm in the trade. I found that this firm had published some hints on the subject, and following is a copy of their circular:—

POINTS TO BE OBSERVED IN COLLECTING RAW STICKS, CANES, &C., FOR WALKING-STICKS, UMBRELLA HANDLES, &C.

Length.—The total length should not be less than 42 inches, end to end, but if possible they should be 48 inches.

Size.—The best sizes are of the diameter of ½ inch to 1 inch, measured about *midway*; they should not be larger than 1¼ inch in diameter.

Form.—It is indispensable that the diameter should gradually diminish from the root or handle to the point, so that the stick is not "top-heavy."

Handle.—It is always better, when possible, to send sticks with some kind of handle; if the plant be pulled up, the root should be left quite rough and untrimmed; if a branch be cut off, a part of the parent branch should be left on to form a knob or crutch handle.

Sticks without handles.—Sticks without handles can be used, especially if they are nicely grown, and have any peculiarity of structure or colour—but if there is any handle, however small, it should not be cut off. Young saplings of the different kinds of palms, bamboos, &c., &c., should always have the root left on.

Short handles.—Occasionally, the form of the root or handle part is attractive, while the stick itself is weak and defective; in such cases the handles only should be sent, and they should measure from 15 to 18 inches in length.

Send only specimens in first instance.—In sending specimens of new sticks it is better to send only small quantities, say, one or two dozens of each kind; then, if approved, further quantities can be asked for.

All kinds of wood.—Specimens of anything remarkable for form or colour, whether in the roots or stems of woody, herbaceous, or reedy structures should be sent, as sometimes the most unlikely things are found to possess value for use either as umbrella handles or walking sticks.

Details.—Details as to quantity to be procured, prices, &c., should be sent, if possible.

I addressed a number of questions to Messrs. Howell & Co., and perhaps it will be better to quote their reply as fully as possible:—"The subject to which you refer, viz., 'the collection of raw sticks suitable for walking-sticks or umbrella handles,' is one in which we need hardly say we are particularly interested, and we are very much obliged to you for the way in which you are endeavouring to bring it before the people in Australia. From time to time we have seen sticks from the different colonies of Australia, and there has been a considerable quantity of one or two varieties sold in this market, the principal one being the midgeon* cane, which we believe came from the neighbourhood of Brisbane. In an article in the *Gardener's Chronicle* of 27th January and 3rd February, 1877, written by Mr. J. R. Jackson, curator of the Kew Museums, that gentleman gives a list of sticks from Australia, amongst which he mentions the Cardwell cane (a species of *Calamus*), also the Loya,† apparently of some species of calamus or rattan, but of very small diameter, and with fantastic rustic roots; there is also the bramble, which possesses a root something like a potato, and which grows to a pretty good size, but none of these canes seem to have met with any success beyond the Midgeon, and unfortunately this has gone completely out of fashion, so that at the present time it is a complete dead letter in the market. We think, however, that there must be a very large number of plants which would be suitable either for walking-sticks or for the handles of sunshades or umbrellas,

* *Kentia* or *Bacularia monostachya*, the Midginbill or Mitchenbill or Walking-stick Palm of our northern rivers (N.S.W.), and usually known in Queensland as the Midgeen Cane.

† (?) A corruption of Lawyer.

and if you could succeed in getting any intelligent collector to send us samples, we should be very glad to give our opinion as to their value, and if we saw any chance of using them, to give orders for a sample parcel in order to try the market. The present time is peculiarly suitable for the introduction of some new articles of this character, as the staple sticks now in use have had their day, and the trade generally would be glad of something new. It is, however, quite a mistake to suppose that any kind of stick possesses a value; it is essential there should be some peculiarity in the sticks themselves, which will render them attractive, otherwise they are reckoned almost as firewood, the price realised for which would not suffice to pay the freight. In other words, we should not want firewood sent from Australia.

"We note with much interest your printed circular in regard to the collection of these goods, and we must say that you have indicated with remarkable exactness the class of goods which would be likely to prove most useful in the market here, and consequently of commercial value. Especially is this the case with the description you give under No. 2, viz., saplings such as tea-trees, wattles, small palms, &c. We think that something new in palms or natural saplings would be more than anything else likely to meet with a demand here. Sticks cut from the solid, unless having a peculiar marking like figured ebony, palmyra, letter-wood (or snake-wood of British Guiana), do not seem to meet with any favour. We should like, however, to see a specimen of the stem of the cabbage-palm. If the outer hard portion should be of sufficient thickness to make a rigid stick, we think there will be a good deal of character in it. Of course it is understood that our sticks are finished, and consequently are very much smaller, especially in the handle part, than they would be in the rough state. We like all sticks sent untrimmed, the root or handle part left as large as possible, so that we may use our own discretion as to the form of handle we may make. The round hook sticks, you will easily understand, are artificially bent, so that it does not follow that all sticks without handles are valueless, provided they possess some distinctive character, so as to be of use either for bending, or having artificial heads put on them. Seeing that they are usually sent with the bark on, which has often to be removed, the size of the sticks should be about 1 inch in diameter, measured about midway.

"As to the kinds of wood which can be used in our trade, it will be sufficient to point out that large quantities of mullein (or *Verbascum*), teasel (or *Dipsacus*), as well as certain kinds of Cacti, the woody structure of which presents a very remarkable appearance when cleared of the fleshy matter which is so abundant on this plant, have been employed as sunshade handles, and they make a very light and graceful handle. We think it would be well if you could get some person to interest himself sufficiently to study the matter, and to send us about a dozen of each specimen of wood which seems at all likely to be useful, taking care to keep duplicates of the same properly numbered, so that in the event of an order being given there might be no doubt as to their identification, and as to what is required. If they are addressed to us, we will give a prompt reply as to the kinds which might be utilised. We think it is as well to mention that it is most unadvisable for any large quantity of sticks to be sent away unless they are properly selected to suit the market. We have known several instances of persons having done this, who have invariably lost money by it. To sum up the matter, we may say that we should like to see specimens of every kind of palm which can be obtained in Australia, also anything of an herbaceous character, having, when dry, sufficient rigidity to carry a sunshade. In addition, any kind of wood which

possesses any kind of 'figure' on the surface of the bark, or on the wood immediately under the bark. We have used an enormous quantity of English furze (*Genista*) lately. This, as you know, is very peculiar in its structure, having holes and knots in the wood, which when finished present a very distinctive appearance. Anything of the 'Genista' type we should think would be likely to be of some use. Some time ago we saw some sticks purporting to come from Australia, called the 'Australian Bay.' It had a peculiar nutty brown bark when dry, with longitudinal indentations, and was inclined to be somewhat flat or square-sided, rather than rotund. A stick of this kind, if it could be obtained with a good handle, would certainly be of some value here. In reference to the prices and quantities of sticks which might be imported, you will see from our observations that it is impossible to furnish this information until we have seen the woods and been able to form some idea as to their value."

In a list of sticks supplied to the London market, I find that small saplings of Tasmanian Blue-gum (*Eucalyptus globulus*) are supplied by Algeria, and none from Australia. Orange and lemon sticks are supplied by Algeria and the West Indies. Surely we could supply these as cheaply as anywhere else.

The variety of sticks we could supply with our remarkably rich vegetation should be unusually great. The industry seems to be full of bright possibilities, but, as this article has already exceeded the length I had intended, I will defer any further remarks to a future issue of the *Gazette*.

No doubt many gentlemen who do not desire to enter into the collection of sticks themselves will be able to furnish the Department with valuable information, which will further the industry as far as this Colony is concerned. In such cases, letters addressed to the Under Secretary for Mines and Agriculture will receive careful consideration. Those who are prepared to embark in the industry at once, or who have accumulated specimens of what they deem to be suitable sticks, are recommended to communicate with Messrs. Henry Howell & Co., direct, at the address given above.

Botanical Notes.

By J. H. MAIDEN.

Two Plants Poisonous to Stock, from Western Australia.

Mr. W. E. Ash, of Albany, Western Australia, has been kind enough to send to the Department specimens of two plants injurious to stock in that colony, and has been kind enough to furnish some notes with them.

Some additional information is herewith given in regard to these plants, which have interest for many Australian stock-owners. The only way to destroy such plants appears to be to frequently burn them off.

No. 1.—Heart-leaf Poison-plant of the Albany District, Western Australia.

(This is *Gastrolobium bilobum*, R. Br., N.O. Leguminosæ).

Mr. Ash states:—"There is said to be another heart-leaf poison to the northward, but this is the most common and very thick in places, more especially about granite outcrops. It grows to a large often-spreading shrub, 6 to 12 feet high, with stems 2 or 3 inches, but sometimes 10 inches in diameter. Said to kill ruminants very quickly, like heart disease. After showing signs of the poison, bleeding is said to cure some cases, which take two or three years to recover."

Bentham, in the *Flora Australiensis*, characterises this plant as the worst of the poison-bushes. There are several other species of *Gastrolobium* in Western Australia, which have played deadly havoc with flocks and herds, such as *G. calycinum*, the York Road poison-bush, *G. ovalifolium*, the Broom poison-bush, and others which are simply known as poison-bushes. One species (*G. grandiflorum*) is found in North Queensland, where it is known as the Wallflower and Desert Poison-bush, and is much dreaded by stock-owners.

With the exception of some brief notes by Dr. Rosselloty, who brought the subject before the Intercolonial Medical Congress of Australasia in 1889, no recent observations have been made on these poison-bushes. In the early forties, when Western Australia began to be largely stocked, a good deal of attention was paid to these plants, for their fatal effects spread dismay amongst stockowners.

Drummond, who collected largely for Kew, thus reports in Hooker's *Journal of Botany*:—"The finest and strongest animals are the first victims; a difficulty of breathing is perceptible for a few minutes, when they stagger, drop down, and all is over with them. After the death of the animal the stomach assumes a brown colour, and is tenderer than it ought to be; but it appears to be that the poison enters the circulation, and altogether stops the action of the lungs and heart. The raw flesh poisons cats, and the blood, which is darker than usual, dogs; but the roasted and boiled flesh is eated by the natives and some of the settlers without their appearing to suffer any inconvenience."

Mr. T. R. C. Walter, in the *Pharmaceutical Journal*, vi, 311, says:—"The blossoms are also frequently eaten by animals, and are, I think, the most poisonous part, for the greatest number of sheep are lost from the poisonous effect of this plant at the period of its inflorescence. When the seeds fall on the ground, the wild pigeons greedily feed and fatten on them; if the crops of these pigeons, containing the seeds, be eaten by dogs, they die; yet the pigeons themselves, when dressed, are good food, and at that season are eaten in large numbers by the settlers. Horses, so far as is known, are not affected by it, at least this is the prevailing opinion, although it is disputed by some of the settlers. . . . When sheep have eaten the herb, the best treatment has been found to fold them, or shut them up in a close yard, so closely packed that they can hardly move, and to keep them thus without food for thirty-six hours."

The plant has yellow or orange flowers, and the leaves are narrow heart-shaped, or rather wedge-shaped. The pod, at all events in its young state, is covered with white silky hairs.

No. 2.—Candyup Poison.

(This is *Stypandra glauca*, R. Br., N.O. Liliaceæ.)

Mr. Ash states:—"This is a herb which is said to cause animals that have fed on it to go apparently blind and run into any sort of object. It seems to be the least fatal of all the poison plants. It is slower in taking effect. It is found in the vicinity of the South Coast."

This plant is common in the neighbourhood of Sydney, the Blue Mountains, and many other parts of this Colony, but I have never heard of it having been reported as a poison plant here. But in Western Australia it is much more abundant than it is with us, and it has so frequently and so consistently been reported as the cause of the "blind disease" in sheep that there appears no room to doubt its dangerous nature.

The Stypandra grows up to 2 or 3 feet high, has blue flowers, and distichous leaves 2 to 4 inches long.

Fluky Grass.

New England squatters have several times sent to the Department a plant which is known to some of them as Fluky Grass, and they ask whether it causes fluke in sheep or not. Its botanical name is *Schœnus Brownii*, Hook. f., and it belongs to the natural order of Cyperaceæ. It certainly, to the ordinary observer, resembles a grass, having grass-like leaves up to about 6 inches in length. The infloresence is of a darkish colour, hence it was described to me once as "a little black-headed grass." It is very indigestible, containing practically no nutritive matter, neither does it contain any injurious substance which would induce fluke. *Schœnus Brownii* as a rule grows in damp situations, and it will probably be found that the climatic conditions which favour the growth of this sedge are also favourable to the development of fluke, and the existence of the sedge and fluke are coincident merely. Every week a plant is sent with the report that it is believed to have this or that effect on stock, but in the majority of cases the senders have made incorrect or superficial observations. To say with certainty that the eating of a certain plant by stock produces certain effects, necessitates a series of very careful observations, and every precaution must be adopted to preclude disturbing influences of every kind. Incorrect observations in regard to plants eaten by stock are by no means peculiar to Australia, and old ideas as to the effects of certain plants are being constantly exploded. As bearing upon the present subject, I give an extract from

Sowerby's "English Botany" in regard to a plant considered to produce fluke in sheep in the old country, and the lesson it teaches is, I believe, applicable to the case of the New England so-called "Fluky Grass."

"*Hydrocotyle vulgaris*, Linn.—"The Marsh Pennywort" of England.—"There is a notion amongst farmers and others that this plant is injurious to sheep or cattle that may feed upon it, and it has accordingly been called white rot and fluke-wort. . . The error in this notion is in ascribing the mischief to any particular plant, rather than to the situation which favours the growth of the plant, and engenders disease in the animals. Were the ground drained, the marsh-loving plants would disappear, but so also would the illness in the sheep which fed in the pasture. Many calamities amongst cattle are by ignorant farmers attributed to their feeding on these marsh plants, which in reality result from the boggy damp grounds on which they live, and in which alone such plants will grow; were the plants gathered and given to the animals on dry ground, we feel sure that no harm would come to them."

An Oat-grass.

Andropogon avenaceus, R. Br., has been sent to the Department from Forster, Cape Hawke, as a palatable and fattening grass for cows. It is apparently sparingly distributed in New South Wales, having hitherto only been recorded from the Clarence, and a few localities between it and Port Jackson, so that its present locality is interesting as a record.

Hop-bush as a Medicine.

There are two kinds of so-called hop-bushes in this Colony, the *Dodonæas* (Natural Order Sapindaceæ), which are called hops, because of their bladdery fruits, and the *Daviesias*, shrubs with yellow or orange-coloured flowers of a pea-shape, and belonging to the Natural Order Leguminosæ. The *Daviesias* are called hops because of the intensely bitter taste of their leaves. These plants are common in the coast and mountain districts of this Colony, and inquiries are often made about them on account of their bitterness. Horses and cattle nip at them, and without harm to themselves, I believe. It is said that horses are fond of the non-prickly leaved species. A gentleman from New England wrote to the Department a short time ago about *D. latifolia*, a species with broad leaves. As far as I know, the plant is a useful tonic bitter, and therefore a readily available substitute for gentian for country people. I have never known it to produce unpleasant effects, but, although I have chewed it hundreds of times, I have never taken it in large quantity, as the bitterness is too intense. The leaves have not yet been analysed, so we do not know the nature of this bitter principle. Unfortunately it is only one of hundreds of Australian native plants which are awaiting their turn to be analysed. Some years ago, Mr. James Stirling, the Victorian Geologist, told me that some Gippsland miners used a decoction of hop-bush leaves in certain complaints, but too much reliance must not be placed on empirically applied remedies. In a note to the Royal Society of Tasmania some years ago, Mr. Alfred J. Taylor said he had been assured that some remarkable cures of hydatids had been effected in Victoria by the administration of an infusion made from the leaves of this plant. I wish I could secure the interest of a few pharmaceutical chemists in the country districts in examining for alkaloids, glucosides, &c., plants which I would with pleasure indicate to them. Some of our country friends have a little more leisure than we in town, and those who engage in the kind of research I have indicated may win a good deal of *kudos*.

On the Choice and Use of Artificial Manures.

By F. B. GUTHRIE,
Chemist.

The practice of using artificial manures has extended so largely of recent years, that I suppose there are few cultivators in this country who have not tried the effect of one or other of the numerous "complete fertilizers," or "special manures," local or imported, on the market.

Their use is steadily on the increase in the Colony, as the land, after repeated croppings, year after year, without manure, becomes impoverished, and yields diminishing and unremunerative crops. The experience gained by others points most conclusively to the benefits to be derived from the proper use of such manures, whether used in conjunction with farmyard manure as dressings in special cases or even as a substitute for farmyard manure, and the results may be readily verified by yourselves.

Nothing is easier than to make an experiment upon a small portion of your crop, a portion sufficiently small to occasion no inconvenience if the experiment fails, but large enough to enable you to judge of its effects. Top-dress a portion of your young wheat crop with a mixture of superphosphate and sulphate of ammonia, and compare the yield of the portion so treated with the remainder. Treat a few square yards of your potato-patch with kainit in the drills when sowing, and treat this portion subsequently in exactly the same manner as the rest of the patch. A shilling or two will cover the cost of these experiments, and the results will enable you to contrast the action of the manure even more satisfactorily than if the whole crop had been manured. If the crops respond to this treatment you will be justified in looking forward with confidence to a similar benefit on treating the whole of the succeeding crop in the same manner.

Manuring of any kind is a question of pounds and shillings. If the addition of 2½ cwt. of superphosphate per acre produces a yield of over 6 tons of turnips as against a fraction over 1 ton produced on the same land without manure, then the expenditure of about 18s. 6d. per acre on superphosphate is surely a profitable investment.

The numbers given in the above example were obtained in experiments by Messrs. Wrightson and Munro, and are quoted haphazard from a number of similar results. The figures are readily verifiable by anyone, and are indeed continually being put to the test by farmers every day.

Artificial manures are, however, somewhat expensive, and their use on a large scale, unless the principles upon which their action depends are properly understood, will be likely to result in waste of money without any commensurate benefit to the crop or the land. The selection of the manure most likely to benefit in a particular case involves a knowledge of the capabilities of the soil and of the requirements of the plant, and requires a considerable amount of judgment.

I propose, therefore, in the following pages to discuss, to the best of my ability, and divested, as far as it is possible of technical language, the requirements of the different crops and soils, and the function of different manures in supplying those requirements.

In the first place, as to the chemical composition of the plant, I shall endeavour to deal with this subject as broadly and generally as possible, so as to avoid technicalities, and only attempt to bring into prominence the most essential points which will enable us to understand the connection between the chemical requirements of the plants and the part played by the soil and manures for their provision. We shall not go far wrong if we assume that nearly all plants are built up of the same elements combined together in different proportions. They are carbon, hydrogen, oxygen, nitrogen, sulphur, phosphorus, silicon, chlorine, and about half a dozen metals in combination. It is in the relative proportion of these elements and their compounds to which the great differences in the chemical composition of the various plants are due.

Different combinations of carbon, hydrogen, and oxygen give us the large class of bodies known as carbo-hydrates, including such dissimilar substances as starch, sugar, the woody structure, cellulose, gum, &c. Hydrogen and oxygen combined give us water; nitrogen, united with the above elements and sulphur, forms the nitrogenous constituents, such as the gluten in wheat. Of the little that is known as to the formation of these substances in the living plant I do not here propose to dwell on. Even less is known of the metals;—their disposition in the plant and the changes they undergo. We are able to detect their presence in the ash in combination with oxygen, phosphorous, sulphur, and chlorine. The ash is that part which remains after the plant is burnt. Now, not only do the quantities of the different elements vary in different plants, but in the same plant some elements are present in quantities out of all proportion to the others. Over one-half of the bulk of most growing plants consists of water. In watery fruit, such as the melon or cucumber, the percentage of water is as high as 90 to 96. Of the remaining portion of the plant the compounds of the metals rarely exceed 2 per cent., and are more often about 1 per cent. This you may readily prove by burning a weighed quantity of any green crop until a white ash, or nearly so, is left. The ash from every pound of such crop will not weigh more than 100 grains.

The point of importance for us to keep in mind is that each of these plant constituents is as necessary for the well-being, even for the existence, of the plant as any other, whether that constituent be present in large or small quantities. The substances found in the ash, though present in minute proportions, are as indispensable to the well-being of the plant as the elements found in the larger portion. Not only that, but if any single one of the ash-constituents is insufficiently supplied—if the potash is deficient or the iron—the plant likewise suffers, although the amount of such element does not in many cases amount to more than a fraction of 1 per cent. Now the volatile portion of the plant—that is, the water,—carbo-hydrates, nitrogenous matter—are for the most part abundantly supplied to them by air and rain, with the exception of the nitrogen in some plants; that is to say, about 98 per cent. of the food of the entire plant is derived from air and water. From the soil it extracts the remaining 2 per cent., consisting of iron, lime, magnesia, potash, soda, and perhaps manganese, combined with sulphuric, hydrochloric, and phosphoric acids, together with the nitrogen as already stated. These substances it is the function of the soil to supply, and where the soil, by reason of its nature, or from having

been exhausted, is unable to meet the demand, we have to assist it by means of manure.

The object, then, of manuring, is to assist the soil in presenting to the plant a portion of the food necessary for its growth; and though the food-stuff thus supplied is extremely minute in comparison with what the plant derives from other sources, it is nevertherless of the greatest importance, and its absence or insufficiency will affect the health of the plant quite as much as the absence of air or of sunlight or of water.

Of these ash ingredients the greater portion is found in all soils in quantities more than sufficient for the requirements of any number of crops; thus, iron, magnesium, sodium, manganese, chlorine, sulphuric acid, silica, are present in nearly all soils in greater quantities than the plant requires, so that there is little danger of the soil becoming exhausted as far as they are concerned. The ingredients, therefore, that we have to supplement by means of manure, are reduced to three or four, viz., lime, potash, phosphoric acid, and nitrogen.

Lime is probably present in most soils in quantities sufficient for the purposes of plant food, and it is seldom necessary to supply it with that object. Its principal functions when applied to land are, firstly, a mechanical one, in modifying the physical character of the soil, and secondly, a chemical one, in rendering available certain insoluble plant foods. Lime acts, however, directly as a plant food, and the different classes of artificial manures fall under one or other of the above headings, according as they supply lime, potash, phosphoric acid, or nitrogen.

The food thus supplied by the soil is taken up in solution by a peculiar process of suction by means of the roots. It is, therefore, necessary that such food should be in a soluble form to be of any use to the plant, which is unable to utilise insoluble material. This is what is meant by the mineral constituents being "available for plant food," and when the terms "latent" or "dormant" and "active" are employed, they mean simply insoluble or soluble in the water imbibed by the root. Those manures which are known as quick-acting manures are such as contain their potash, phosphoric acid, and nitrogen in a soluble form at once available for the plant; those which are slow-acting contain these substances in a more or less insoluble condition.

In these latter cases a gradual decomposition takes place in the soil, due to the action of chemical agencies within the soil and assisted by the action of the roots of the plant, by which the insoluble compounds are converted into soluble ones, and so become gradually available, the beneficial action extending over a longer period of time.

A good example of these two conditions is found in the state of the phosphoric acid in bone-meal and in superphosphate respectively. Bone-meal consists of bones ground to a powder, and the compound of phosphoric acid and lime which it contains is insoluble in water to any appreciable extent. In course of time the agencies at work in the soil render it soluble. Superphosphate is a compound, manufactured by treating bones or mineral phosphates with strong oil of vitriol, by which treatment a different compound of phosphoric acid and lime is produced. This compound being readily soluble is at once made use of by the plant, but is not so lasting in its effects as ground bones.

From the preceding considerations which I have endeavoured to make as clear and as general as possible without going into precise details we shall have realised that a definite relationship exists between the requirements of the plant and the nature of the food with which we have to supply it. All plants do not take up the constituents presented by the soil in the same

proportion, and are consequently benefited differently by different manures. No amount of nitrogenous manure will materially benefit the pea-crop, but a small quantity added to the land in which wheat is grown will produce a considerable increase in the yield. With all crops there is a special ingredient or ingredients which they require more than others. Some require potash, others nitrogen, whilst others do not thrive unless there is abundance of phosphoric acid.

What these special requirements are, and the nature of the different manure with which they are met, we will inquire into at a later stage.

We now know that in the selection of the proper manure for use in any special case, we have in the first place to consider the requirements of the crop in question, and secondly in how far the soil can supply those requirements.

The latter question is most satisfactorily answered by an analysis of the soil; but it must not be forgotten that it is not possible to analyse the soil with the precision that is attained in the assay of an ore, or the analysis of a manure. The manner in which soils are produced renders it impossible that any considerable area shall be of uniform composition. Slight differences in the composition of the original rock will materially alter the nature of the soil in the neighbourhood—in fact, the destructive agents at work in the formation of the soil, act so unequally, and are affected by so many local conditions, that it would be very astonishing to find a large paddock of uniform chemical composition throughout. Even if we could by any means obtain a sample which should represent the average composition of the soil, we are met with the further disadvantage that no method of analyis yet devised is able to give us much information as to the availability of the material for plant-food. We cannot reproduce in the laboratory the action of the natural agents upon the soil. We can estimate the total quantities of the food-constituents present, but we cannot accurately state how much is immediately available, and we cannot at all say what quantities will become available in any given time. Too much, therefore, must not be expected of a soil analysis. Of itself it is of little value. It is, however, exceedingly valuable when studied in conjunction with the nature of the soil, its physical properties, its surroundings, previous history, and climate. What soil analysis can do for us is to show us in what ingredients a soil is deficient; whether it contains substances injurious to plant-life; whether it would benefit by the addition of lime; and, generally, what treatment it requires, and what manures.

With regard to the second point to be taken into consideration in the choice of manures, namely, the requirements of the plant, we have more satisfactory data to work on. The experience of others as to the effect of certain manures, and the chemical composition of the plant itself, are guides to which we may safely submit ourselves. But here again it is possible to fall into error. The analysis of two crops (say wheat and a root crop) shows us that the wheat crop contains a far greater proportion of phosphoric acid than the roots, but we should be wrong if we assumed that the wheat would be more highly benefited than the roots by a manure containing phosphoric acid. As a matter of fact, root crops are specially benefited by phosphatic manures, and cereals in a lesser degree. Similar instances are numerous, and I draw attention to them simply as a warning that it is possible to misread the information afforded by chemical analysis, especially if we persist in relying upon it alone.

I have pointed out that this is more particularly the case in soil analysis. There exists, however, one analyst whose methods are open to none of the

objections I have enumerated, and whose results are so stated as to require no modification. You can consult him at all times without fee. His report is devoid of technical language, and is such as you can understand without previous knowledge. He is—the plant itself.

The following simple experiment, suggested by the great French authority, M. Ville, will indicate the manner in which the plant may be made to analyse the soil:—

Sow in close proximity, and upon the same piece of land, a small patch of wheat and a small patch of peas. The land should be unmanured, and both patches should have received the same previous treatment. The behaviour of these two crops will furnish you with a guide as to the quantities of nitrogen, phosphoric acid, and potash available in the soil quite as reliable as the most accurate chemical analysis.

If the two crops flourish equally well, your land is well supplied with the three ingredients above named.

If the wheat crop fails, and peas flourish, nitrogen is wanting, and the advisability of applying a nitrogenous manure suggests itself. If, on the contrary, the peas are sickly, the cause is probably deficiency in potash and phosphates.

Such experiments as the above we can multiply, as we learn more exactly the chemical requirements of different plants.

In short, the condition of the crops themselves, and the presence or absence of certain trees, grasses, and even weeds, will afford us a considerable amount of information as to the chemical character of the soil.

Chemical Notes.

By F. B. GUTHRIE,
Chemist.

The following analyses of blood manure, bonedust, and meat from the Bourke Meat Preserving Works may be of interest:—

Bonedust mixed with Meat.

Moisture	=	6·39	
Organic and volatile matter...	=	67·61	(Nitrogen = 6·804; ammonia = 8·262)
Sand and insoluble	=	·98	
Tri-calcium phosphate ...	=	22·47	(Phosphoric acid = 10·29)
Calcium carbonate	=	·88	

Mechanical condition.

Fine	=	38·5
Medium	=	56·0
Coarse	=	5·5

This is a highly nitrogenised bonedust, and its manurial value is £5 11s. per ton.

Blood Manure.

Moisture	=	10·63	
Organic and volatile matter...	=	83·99	(Nitrogen = 12·376; ammonia = 15·028)
Sand and insoluble	=	2·44	
Phosphoric acid	=	·83	

This is an excellent nitrogenous manure, in good mechanical condition, and should prove an excellent manure for wheat, grass, and root crops. The manurial value of its fertilising ingredients is £7 11s. per ton.

The above are obtainable at Messrs. Bartley, Hodgetts, & Co., 111, Sussex-street, Sydney.

Comparative Value of Farmyard Manure and Artificial Manures.

A correspondent having inquired as to the relative manurial values of farmyard and Sugar Company's manure, the following comparison may be useful to others.

One ton of farmyard manure contains, roughly, the following quantities of fertilising ingredients:—

Nitrogen	8 lb.
Potash	6 lb.
Phosphoric acid	6 lb.

In 3 cwt. Sugar Company's manure No. 3 there are of:—

Nitrogen	9 lb.
Potash	6 lb.
Phosphoric acid	42 lb.

That is to say, 3 cwt. of Sugar Company's No. 3 contains about the same quantities of nitrogen and of potash, and seven times the quantity of phosphoric acid, as 1 ton of farmyard manure.

The cost of 3 cwt. Sugar Company's manure is about 19s. 6d.

The manurial ingredients in the Sugar Company's product are in a very soluble form, and their effect is more rapid. On the other hand, it contains no vegetable matter like the litter in farmyard manure.

Composition of Fodders.

The following analyses of certain green fodders, as cut for feeding, may be of interest to farmers in indicating the relative feeding values of the different fodders examined :—

	Water.	Ash.	Fat.	Fibre.	Crude Protein.	Carbo-hydrates.	Nutrient value.	Ratio of Proteids to Carbo-hydrates.
Rape	79·06	1·85	·73	3·95	1·24	12·45	15½	1 to 11½
Mangold	86·15	·88	·44	1·13	1·91	9·49	12½	1 to 5½
Cabbage	86·28	1·07	·48	1·83	1·17	9·17	11½	1 to 9
Field-peas ...	81·75	1·21	·81	7·85	3·09	5·29	10½	1 to 3
Oats	80·12	1·72	1·19	6·73	2·57	7·66	13	1 to 4
*Sour ensilage ...	60·86	4·78	1·17	13·74	4·15	15·35	22½	1 to 4½
Planter's Friend...	73·32	·95	·55	6·06	2·28	16·84	20½	1 to 8
Imphie	73·91	1·08	·99	5·74	1·56	16·72	20¾	1 to 12⅓

* The amount of acidity in the sour silage was not determined.

National Prizes Competition, 1893.

By F. B. KYNGDON, M R.A.C.

Champion Farms.

(*Continued from page* 104.)

In the last number of the *Gazette* were published full details concerning each of the farms of the large class (over 200 acres and not exceeding 1,280 acres) entered for the Champion Prizes, and in this number I propose to deal in a similar way with the entries for the prize for the smaller class, viz., mixed farms up to 200 acres.

The following is a list of the entries in this class, with the percentage of points awarded to each:—

	Acres.	Percentage of points.*
Haywood Bros., Pambula	184¾	88·31
Bernard Muscio, Taree	50	86·42
E. J. Dening, Kempsey	22	84·10
J. W. Johnson, Grafton	53	81·05
H. M'Lachlan, Grafton	57	80·33
E. Gibson, Unanderra	103	78·94
D. Doust, Grafton	180	78·63
G. K. Green, Tumut	160	77·78
M. Waters, Hawkesbury River	100	76·44
W. Swan, Albion Park	160	66·31

The report on each property is given in the order of date of inspection.

G. K. Green, Tumut.

South Tableland District.—Place, No. 8; points, 77·78 per cent.; arable, 102 acres; pasture, 17 acres; homestead and paddocks, 3¼ acres; orchard, 7½ acres; let off, 30 acres; total, 160 acres.

(16 October, 1893.)

This farm of 160 acres is distant 5 miles from Tumut, and occupies perfectly flat land, the deposit of the Gubragandra River, a tributary of the Tumut River, which borders the property on one side, the other boundaries being by public roads. Towards the south, and within half a mile, commence the foothills leading to the Bogong mountains, which quickly reach an elevation of 1,100 feet, and shelter from southerly winds, but those from the north sweep the plain. The character of the soil is fairly even, being a blackish

* See tables at page 192.

sandy loam, in many cases over 10 feet in depth, reaching to the boulder bed of the river, and therefore the permanent water-table. The highest land is nearest the banks, but, owing to their sloping away, water lies after rain in some of the paddocks, and much might be done to drain if neighbours could be induced to continue the open ditches to an outfall, and thereby improve their own land. These moist lands afford good grazing during summer, and the farm, as a whole, is certain to yield a crop every season unless an exceptional flood occurs. With water so easy to reach there is no need for its conservation save by tanks for household purposes.

The property was purchased off Michael Quilty seventeen years ago. Forty acres were then under cultivation, and the rest was a dense river scrub, the fencing being old and the house a sort of gunyah. Mr. Green, during nine years' occupation, has, with his own labour, a man being hired when needed, cleared all but 10 acres, erected substantial fences, built the present house and farm-steading, and brought the farm into first-class order. By reason of ill-health he next resided in Sydney for five years, when the land was leased for £200 per annum, but it fell off in condition, and Mr. Green having returned, has during the last three years restored it to the state it was in prior to letting. The purchase money in 1876 was at the rate of £4 16s. per acre, but the value may now be estimated at £14 per acre.

The paddocks are moderate in size and well fenced, principally with two-rail of very substantial build, of water-gum timber, the trees being of a large size, and are split by means of a charge of powder. Instead of burning off, posts and rails are got out for future use, and the rest of the timber is cut into firewood and stacked near the house, some 40 cords being stored there now. Old fences are strengthened to last for a time by means of wires run on the top and between the two rails. A Government road fence, rankly overgrown with briars, is about to be cleared and replaced by Mr. Green with post and two rails. Weeds grow apace in this fertile soil, and a just cause of complaint lies against the State through the neglect of keeping roads free from noxious rubbish. There are gates near the homestead and slip-rails elsewhere.

The residence is a substantial four-room slab cottage, roofed with iron, having a detached kitchen and offices, and standing in the midst of a flower-garden and orchard. Close by is a luxuriant clover-paddock bordering the river, and containing many very fine elms, willows, elder bushes, and a white cedar, which testify to the richness of the deep loam and its never-failing moisture. The farm buildings are at a distance of 200 yards, and comprise a slab-built stable, floored with slabs, milk-bail and yard with calf-pen adjacent, and the barn 60 ft. x 20 ft.

The implements comprise a one-furrow plough, by Howard, a two-furrow plough, by Ritchie, wood-framed harrow, Howard's A-shaped horse hoe and scarifier, "Planet" horse-hoe, wood-roller, A B C corn-sheller, spring cart, tip-dray, and buggy; reaping and threshing machines and chaff-cutter are hired.

The system of farming pursued is to alternate maize with oats, some of the latter being cut for grain, and the rest for hay. A small breadth of wheat is also grown for sale to local millers. The bulk of the maize and oats with surplus of the hay over home consumption is sold locally. After the corn is pulled, cattle pick up a good living all the winter, and the land, when rest is required, is laid down in grass for some years before being again cropped with cereals. After the oats are cut, stock are allowed to run on the stubbles till May, when ploughing follows.

The farm is laid out as follows:—Maize, 71 acres; oats, 23 acres; wheat, 8 acres; cultivated, 102 acres; pasture (rest), 17 acres; homestead and paddock, 3½ acres; orchards, 7½ acres; land let off, 30 acres. Total, 160 acres.

The method of cultivation is to watch the weather carefully, in that wet renders the land too soft for working, and cultivation is pushed along with whenever possible. Great pains are taken to get a fine tilth, the land having a tendency to form clods if worked wet. Maize is planted at the intersection of squares, got by running furrows 4 feet apart crossways, and three corns are dropped at each point. Horse tillage is pursued till the plants grow too big, and then weeds are kept down by hand; cobs are pulled in May, husked in the barn, the cores and husks going for litter in the piggery and cow-yard. The stalks remain till the land is sufficiently dry to allow of the tillage for the next crop, when they are ploughed in. Maize has been grown continuously for thirty years. The usual yield is from 45 to 70 bushels per acre, on virgin land over 100 bushels may be got, and from 60 to 70 acres are planted annually, the total product being about 1,100 bushels. The varieties sown are from seed recently obtained from the Clarence, a few grains of "Golden Drop" and "Golden Dent" having been sent to Mr. Vicary, a neighbour. Two years ago Mr. Green sowed half a bushel of each, and from seed thus acclimatised the present crops are grown. The "Golden Drop" of last season, binned in the barn, presented a rich yellow transparent corn, whilst the "Golden Dent" was less so; both varieties yield equally well, and on good land choice acres were estimated at 100 bushels and 90 bushels respectively. Some corn is sold for seed locally, only, however, at current rates (3s. 6d. per bushel), and the farmers are much indebted to Messrs. Vicary and Green for obtaining so good types from a distance.

Oats for grain and hay occupy 23 acres, the cutting being done by a hired string binder. For both there is a good local demand, hay being sold up to 30 tons per annum, the rest is kept for home use, and chaffed by a neighbour at 10s. per ton. No advantage is gained by sowing oats early, the August planting giving the best returns of about 3 tons of hay to the acre, or 45 bushels of grain. This season White Tartarian from New Zealand were sown.

About 8 acres are this year in wheat—"Purple Straw"—from seed sent by the Department of Agriculture two years ago to Mr. Bridle, of Bumbowlee Plains, and purchased off him at 5s. per bushel. The flags at the time of my visit were luxuriant, rust not visible, heads not yet appearing, and a prospect of a yield up to 36 bushels per acre. Last year's sample in the barn, and about to be sold, presented a plump, starchy, dry, yet soft berry, much preferred by millers. "Purple straw" has, as yet, excelled all others grown in the Tumut district, and from its early maturity, escaping somewhat, if not wholly, the rust that is sure to attack late-sown wheat. There was a most instructive object lesson in progress at the time of my visit, twelve varieties of experimental wheat being grown side by side. A plot of "Jubilee" covering 192 square yards was sown with 4 lb. of seed got two years ago from a 2-oz. packet from the Department, and last year's yield was kept for this season's sowing. The flag was luxuriant, heads showing, no rust visible, and in height one-third more than "Purple Straw." "Trafalgar," sown from seed similarly obtained, had flags of a deeper green, equally tall, but less withery, and heads a week later. "Blount's Lambrigg," although sown one day later than the above, had a low creeping habit, with more withered flags, and only half the height. "Early Para" showed a good

clean flag, with heads just appearing, and a few inches shorter than "Trafalgar"; it had stooled well, although sown later—in the middle of June. "Victorian Defiance" presented a poor stool, narrow flag, of medium height, heads about to appear, although rather irregular; they were somewhat bearded, and the crop did not appear encouraging, but on good land the yield might be fair. "Ward's Prolific" was good looking, of a bright colour, fully flagged, but no heads, as yet, showing, being sown the third week in June. "Farmer's Friend," was less promising than the above, as was also "Smith's Nonpareil." "Summer Club" presented a narrow, pointed, upright flag, and although sown in May was very slow to start, yet had tillered well. "Leak's" was the finest wheat on the farm, and twice the height of the above, although sown the same week in May. "Early Para," however, excelled it in rapid maturing and luxuriance, since it was nearly equal in appearance, although sown a month later.

A paddock of 17 acres, previously cropped with maize, is now under grass, having been rested four years ago and since grazed. It will keep the six draught horses and two milch cows this coming summer. This is the land that is wet, and might be improved by drainage if neighbours would assist. Should the picking off the maize and oat stubbles be abundant, a beast or two will be purchased to fat and salt down for home use. Grass hay and silage are not made.

Manure is conserved for use on the orchard, and is made from horse, cow, and pig droppings, there being a good-sized heap recently got out from the piggeries.

The live stock number 17 horses, 2 cows, and 170 head of poultry. Several pigs are usually kept, but at the time of my visit the last had been sold, and the intention is to buy a pure-strain of Berkshire for breeding purposes. The horses comprise 8 active draught, 3 good saddle horses, one being of a handsome carriage type; a roadster filly, 2 years old; 2 farm colts, to be broken in during 1894; and 2 other colts the year after, displacing older ones that will be sold. There were also a good-looking pony for the children and a foal. The stallion "Hero," the father of the four farm colts, was the property of a neighbour, and his young 3-year-olds are worth £10 each, the price of horse stock being very low. Two milch cows are kept, both Durhams, of excellent type, purchased in the district three years ago for £13 the pair. Although the calf ran with one during the day, she gave 2¼ gallons of milk. Possibly no clover pasture could excel that of this farm for dairy purposes.

Mr. Green is a successful exhibitor of poultry, having won many prizes locally. The pure breeds are kept in separate compartments of a long, well-built poultry-house, and comprise Australian game, Partridge Cochin, White Brahma, Langshan, Orpington, Dorking, Leghorn, White Aylesbury ducks, and Guinea fowl. The strains have been acquired from noted breeders in Victoria and this Colony. In an isolated district fancy prices are not got, but for a setting of eggs 10s. may be paid. In reality, the neighbourhood has benefited through Mr. Green's enterprise. The breeding of pigeons for match purposes brings in 1s. apiece for the birds supplied. Several hives of bees are kept, and the honey, as well as the eggs, table fowls, and butter, are sold locally.

The vegetable garden is merely for house use, but so freely does every variety flourish, particularly onions, that pure seeds might with advantage be grown for the trade. There are 8 acres of orchard, including the old orchard of 1½ acres, the house orchard of 1½ acres, and the new orchard of 5 acres. The first-mentioned contains many notable trees, indicative of the suitability of the soil for the growth of fruit. An English walnut was 25 feet high. From

an apricot 25 feet high £7 was made last year by selling the fruit at 3d. per dozen. The pears from a tree 30 feet high, with a trunk 20 inches in diameter, sell at 6d. per dozen. An apple-tree 28 feet high bears enormous fruit, that measure 18 inches in circumference. These trees were purchased with the property seventeen years ago. About $1\frac{1}{2}$ acres of reclaimed river-bed were planted three years ago with a varied selection of trees, some being got from growers at Wagga Wagga, others from Sydney. Four acres in 1892 and 1 acre in 1893 have also been planted, the land being choice flat alluvial. The trees throughout looked well, growing freely, with clean stems, and few indications of insect attack. There is a good sale of fruit locally, and the orchard adds from £40 to £50 per annum to the farm proceeds. Melons of many descriptions are also grown, as much as £20 in one season having been realised.

Book-keeping is quite elementary, a record of sales and purchases being kept.

The work of the farm is done by Mr. Green and his son, 18 years of age, the family helping in poultry keeping, preserving fruit for home use, and bees.

The subsidiary aids may be enumerated as follows:—Co-operative family labour; sales of seed corn, oats, and wheat, also eggs, table-birds, and pigeons; the use of home-cured bacon; home carpentry; bee-keeping; sales of fruit and melons. All repairs are done by tradespeople.

The points of interest are experiments in wheat culture, the use of seed maize acclimatised from the Clarence, the levelling and planting of the old river bed, extended orchard growth, and pure breeds of poultry.

The management, with a view to profit, is to make maize the main crop, to grow oats for grain or hay in next proportion, a minor crop of wheat is taken, and the orchard is a source of revenue. The vegetable garden, together with all the dairy produce, is for home use as well as home killed meat and bacon. The live stock comprise working horses, with the sale of one or so now and again, two cows for the home dairy, fat swine for sale or bacon curing, and choice poultry.

The farm is a flat alluvial seldom subject to flood, having a deep, friable soil that will produce large crops of maize and cereals, either for hay or grain; clovers grow luxuriantly; fruit trees do exceedingly well; and there is no fear of soil exhaustion. The ground has been reclaimed at no small labour from dense brush, carrying heavy timber, which has been utilised for fencing or stacked for fuel. The cultivation throughout is thorough, and the marketing is well done. The implements are suitable, and the string-binder and chaff-cutter of neighbours are hired in preference to ownership. The labour of the farm is that of Mr. Green and his son, with hired hands when required; and the area is a comparatively large one for so few persons to work. During the past year a great deal of time has been devoted to reclaiming the old river channel that was much overgrown with brush, planting an orchard, and lining roadways with greengages and preserving plums.

The turnover for the year may be taken at £400. The live and dead stock and improvements, house and farm buildings, may be valued at £1,060. The original outlay was £750, and the present value of the land may be regarded as about £2,240, so that the increase of £2,250 may be looked upon as representing the skill and labour of seventeen years of occupation, besides the whole of the household and personal expenses during that period. The soil and climate of the Tumut district are exceptionally good, and this farm shows what can be done with proper farming.

Michael Waters, Hawkesbury River, Richmond.

South Coast District.—Place, No. 9; points, 76·44 per cent.; arable, 80 acres; pasture, 14 acres; homestead, 4 acres; orchard, 2 acres; total, 100 acres.

(25 October, 1893.)

Mr. Waters has been connected with this farm for a long term of years, first as a farm servant to Mr. William Parnell, who then owned it, next as a lessee of 50 acres, and when in 1872 the estate was for sale, Mr. Waters, through timely financial assistance, was enabled to purchase the 50 acres for the sum of £950. The fences were useless, and a small orangery of good trees alone existed as an improvement, yet seasons were favourable and prices good, so that in a few years the debt on the farm was paid off. In 1878 an adjoining 50 acres were purchased, on terms, for £1,000, and now no money is owing. This farm of 100 acres abuts on the Hawkesbury, the river bottom being 45 feet below the plateau on which the homestead is erected, and the major part of the farm is 10 feet higher. In a great flood the backwater would cover the farm, but the main current would be at Windsor 4 miles distant, and since river banks are always the highest point in a wide valley, the homestead would be as it were an island. The town of Richmond is 2 miles distant, and to it and the railway there is a good road. The market for the produce is partially local and mainly the metropolis. The geological features are that the river silt has been chiefly derived from the Hawkesbury sandstones of the main mountain range, and where the heavier particles are deposited, sandy soils of the poorest description result, but the finer silt has formed the soil of Mr. Waters' farm, which occupies some of the very best Hawkesbury River land. It is porous and friable, of great depth, contains a fair proportion of organic matter, and is replenished from time to time by flood deposit.

Drainage is not necessary, although on one portion of the farm there is a lagoon and wet land supplied by soakage from the higher land on which the town of Richmond stands; but it is too valuable a pasture in dry summer time to be drained. Rain-water is conserved in tanks for household use. The fences are serviceable, the majority being 3-rail, some with 5-wire, and as timber is scarce, fences are made to last as long as they can, the divisional ones being of use to allow cattle to feed on the stubbles.

The residence is a comfortable six-room cottage of wood, standing in a neat garden with flowers and many shrubs. The farm buildings form a group by themselves, and were built by Mr. Waters and his sons, assisted by a carpenter. The hay-shed, of round saplings with iron roof, is 70 feet by 35 feet, and has partitioned off a buggy-house with fodder and chaff-room. The barn is of slabs, with iron roof, measuring 60 feet by 27 feet. The stable, 50 feet by 18 feet, is of slabs and saplings, with bark roof, and contains four stalls and two loose boxes. Another stable is 10 feet by 12 feet, also a cottage of wood and iron roof, 30 feet by 10 feet, with harness-room. The piggeries consist of a large pig-proof yard, with some roof shelter. These buildings are typical of the Hawkesbury, where not much shelter is needed for live stock, and may be taken to represent an outlay of £300.

The implements comprise five one-furrow iron ploughs (local make), three one-furrow "Deere" chill, one double mould-board by Howard; "Planet" horse-hoe, "Jersey" horse-hoe (Ames Co.), and an iron one of ordinary pattern made locally; two harrows with wood frames; two wooden rollers; iron horse-rake; "Farmer's Friend" corn-planter; corn-winnower, corn-sheller (Manners of Taree); horse-power (Richmond and Chandler), maize-

stalk chopper for use in the field (local make), "Paragon" mower (Hornsby), three drays with frames, spring cart, and buggy. Repairs and farriery are done by tradespeople. The "Deere" chill ploughs are highly approved, a single furrow drawn by two horses doing the work of a double furrow with three horses, and leaving an excellent tilth.

The system of farming pursued is to make maize the main crop, 50 acres being planted. Next in importance come hay crops, such as lucerne, wheat, and oats, 17 acres; pumpkins, 13 acres, besides where sown between the maize; potatoes, 1 acre; lagoon and pasture, 14 acres; homestead, orchard, vegetable garden, and yards, 5 acres; total, 100 acres. The chief market is the metropolis, and catch crops are got, if possible, such as turnips, green barley after hay, sorghum, and jam melons.

The ground is prepared for maize in June, when the stalks are chopped and ploughed in; a cross ploughing is made in September, furrows are struck 4 feet apart by Howard's double mould-board plough, and the corn is planted by the "Farmer's Friend." Pumpkins are planted between the maize in rows 16 feet apart, and spaced at 10 feet intervals. Horse and hand hoeing are pursued to keep down weeds. The cobs are gathered in March and husked in the barn, the husks being picked over by the live stock, and the cores serve for fuel.

The example set by the College Farm in drilling maize, so that the plants are equally spaced, at 16 inches' intervals, has been followed by Mr. Waters, and with satisfaction, since economy in labour is gained without loss of efficiency either in hoeing or yield. Hitherto, dropping seeds by hand at intersections 4 feet apart has been the Hawkesbury custom. Mr. Waters has also been the first farmer in the district to introduce a double mould-board plough in lieu of the usual two bouts of a single furrow, in order to mark out the rows, and a "Farmer's Friend" drill is used. The closing in of the open furrow and the hilling is accomplished by a horse-hoe fitted with side wings or mould-boards. One bushel of seed is used for from 4 to 5 acres.

The "Large Hawkesbury Yellow" corn is preferred, since the yield has measured 110 bushels, the return of the first prize acre for 1892, and the average is 80 bushels per acre. "Champion" and "Hogan's Red Spindle" are also approved varieties.

Lucerne is laid down for five years, and then five crops of maize are taken. The land is prepared by three ploughings, so as to get it particularly clean, and 15 lb. of seed per acre is sown broadcast either in March or September, a less quantity being considered unwise. No difficulty is experienced with dodder, since the seed is obtained from Mr. Richard's Bulga property, costing 1s. per lb. The first cutting is made when the lucerne is about to flower in about six week's time, and then two more, completing the first year; afterwards six cuts per annum are taken. The yield is 1 ton per cut per acre, or 6 tons per annum. The climate is very suitable for haymaking, and great pains are taken not to unduly injure the leaves by much turning. The cutting is done by the "Paragon" mower, the crop falling behind it and remaining untouched for a day, and the iron horse-rake is used to gather it into wind rows; next it is forked into heaps and stacked in the hay-shed, where it settles rapidly down and is trussed for sale. The bulk of the crop is sold chiefly in the neighbourhood, and a proportion is retained for home use. The return per acre may be taken at 6 tons, at £3 5s. = £19 10s. Oats are cut for hay by the "Paragon," being delivered into sheaf bundles, which are bound by straw bands, stacked for two days, and then carried to the hay-shed, the yield being 3 tons per acre, selling at £3 per ton—in all, £18 per acre.

Pumpkins are largely grown, the 13 acres being apportioned as follows:—pumpkins, 8 acres; jam melons, 2 acres; water melons, 1 acre; Royal pumpkins, 1 acre; cattle pumpkins, 1 acre, besides those grown between the maize. These crops make a quick return, for pumpkins sown in September are off in January, and green barley or wheat is immediately put in. All varieties sell readily. Last year 5 acres of pumpkins yielded 612 dozen, fetching from 4s. to 6s. per dozen, whilst the inferior ones were used at home for cattle and pigs. Water melons yield 40 dozen per acre, and fetch 5s. per dozen. Jam melons give 12 ton per acre, at £1 5s. per ton. Turnips are sometimes taken as a catch crop, yielding 5 tons to the acre, selling at £2 10s. per ton. Two crops of potatoes are got per annum, the first lot put in in September are off in December, and those planted in January are harvested in May and June, the yields being 6 tons per acre each, or 12 tons in all, selling at from £4 to £6 per ton. "Brownell's Beauty," "Skyblue Kidney," "Scotch Grey," "Dean," "Early Puritan," "Ruby Red," and "Satisfaction" are varieties grown. The double mould-board plough is used to open out the furrows in which the sets are planted.

No system of manuring is pursued, nor are fertilisers purchased. Stable manure with husks and cores are rotted in a small uncovered heap. The pig manure is collected from the large open yard. Maize-stalks are ploughed in. What a benefit manuring confers was to be seen in the lucerne paddock wherever droppings had stimulated a luxuriant growth.

Reference has already been made to the conservation of fodder crops. There is no systematic laying down of grasses and lucerne. The 14-acre pasture paddock with lagoon is used for the stock in summer, and its water couch-grass proves most serviceable, so that it would not be wise to drain the land.

The live-stock number 19 horses, 30 cattle, 6 swine, and 200 head of poultry.

Horse-breeding forms a feature of Mr. Waters' management, and adds considerably to the annual turn-over. The enterprise of the late Mr. Andrew Town in importing pure Clydesdale stock has been of the widest benefit. At first Mr. Waters secured good mares in foal to Town sires, and the produce has at all times fetched good prices, from 100 to 130 guineas being frequent figures. The two grand entires, "Prince Colin" and "Commodore," now on the farm have been bred by existing mares, and have won prizes at the Metropolitan and local shows, but times are bad financially when the service fee of such horses is lowered to £2 5s. The brood-mares are also high-class, and number seven, three being prize heavy draught, and four active farm mares. There are also four heavy draught geldings bred from the above, two fillies 2 years old, one colt of the same age, one colt 1 year old, all being Clydesdales, and one yearling blood colt. Two hackneys are kept for buggy and saddle, as well as a blood mare, "Hasty," a frequent prize winner, and now with a colt; in all, nineteen horses.

There are fourteen milch cattle, seven in milk and seven dry; they are of the usual Hawkesbury type; and surplus butter to the extent of £25 is sold yearly. The heifers number sixteen—in all, 30 head of cattle. Prize swine are kept, and at present five breeding sows of the improved Berkshire type derived from Town and Deane strains are installed, the boar of a neighbour, of New Zealand extraction, being availed of. Inferior maize and pumpkins form their principal food. Nine pigs, of from 150 to 200 lb., are killed annually, the greater part of the bacon being used at home, and dealers pick up about fifty suckers per annum at from 6s. to 7s. each when six weeks old; pigs bring in about £20 per annum. There was one store fattening in November.

Poultry are represented by Australian black and red game, 200 head being kept, realising by eggs and table birds £20 per annum. Mr. Waters' birds have been frequent prize-takers, lay well, and are very choice for the table.

The garden is for home use, a portion of a field near to the farm-buildings being used for the purpose. The orchard adjoins also the farm-buildings, and covers over an acre of ground, two-thirds being citrus and one-third mixed trees. The citrus trees are over 40 years of age and bear fairly well. The stone-fruits form also large trees of about nine years standing, but the orchard evidently does not receive the attention it deserves as to spraying and pruning.

Book-keeping is merely a record of sales and purchases, and the totals are available for several years past. The labour of the farm is accomplished by Mr. Waters, his two adult sons, and the co-operative aid of the family.

The subsidiary aids may be enumerated as co-operative family labour; sales of maize and potatoes for seed, pure Clydesdales, Berkshires, and game birds, sales of dairy produce, bacon, and poultry, also orchard fruits and hire of maize-chopper.

The points of interest are the keeping of pure horse, swine, and poultry stock. The large area under tillage worked by family labour. The introduction of maize planting in drills, and the use of a double mould-board plough.

In reviewing the management with a view to profit, the utmost appears to be won from a soil incapable of exhaustion, because floods renovate it from time to time. The maize crop yields extremely well, the lucerne hay is made as perfectly as can be, double crops of potatoes give 12 tons to the acre, and the various pumpkin crops fetch good prices in Sydney markets. The cultivation is, in all cases, carefully done, and weeds are kept under. Doubtless, were manure better made, and fertilisers purchased, even larger crops could be secured. The returns for the past thirteen years show admirable results, and the average of £658 per annum from 100-acre farm, of which 80 acres are under the plough, is made up as follows:—Maize, £250; hay, lucerne and oaten, £145; potatoes and pumpkins, £75; poultry and dairy, £75; pure-bred live-stock, £120—in all, £665. The capital invested may be arrived at by taking the actual purchase cost and an estimate of the property. The land cost £1,950, and £1,320 has been expended as follows:—homestead, £750; live-stock, £370; and implements, &c., £200—in all, £3,270. The present auction value of the farm may be put at £100 per acre, £4,000, which with £1,320 as shown above makes £5,320. If from this the purchase money, £1,950, be deducted, £3,370 represents the outcome of Mr. Waters' life-long farming, in addition to which there is the whole of the household and family expenses.

Edward Gibson, Fig Tree, Unanderra.

Place, No. 6; points, 78·94 per cent.; arable, 16½ acres; pasture, 76½ acres; homestead and paddocks, 9½ acres; orchard, ½ acre; total, 103 acres.

(31 October, 1893.)

Mr. Gibson arrived in 1858 from the north of Ireland, where he had experience as a boy on his father's farm. Possessing but little money, he obtained employment and experience for eighteen months on a dairy-farm in the Illawarra District. He then rented a small farm in the same district, and with financial help was able to stock it with dairy cattle, and in eight years' time sold off and realized £1,800 profit as a tenant farmer. He next purchased a property near Dapto, which, with all its stock, was handed over two and a half years ago to his two sons. The present Fig-tree farm was

bought five years ago, with a three years' lease to run out. Two years ago he built the present commodious residence and commenced dairy-farming, some lands adjacent being rented for running dry cows and springers. The farm entered for competition is 103 acres in extent, and of the choicest description. With the exception of a low hill, covering 10 acres, it is wholly an alluvial flat, bounded on three sides by the constantly flowing "American" Creek, and is scarcely ever subject to even a few hours' flood. The position is sheltered, save from strong westerly winds. By road the distance from Wollongong is 2 miles, and with the collieries near by constitutes the principal market. This local disposal is a particular feature of Mr. Gibson's profitable management. The sea is 2 miles away, the cliffs of the Illawarra Range are 2 miles further inland, and the Unanderra railway station is about 1½ miles away. The climate is typical of the Illawarra District, where the coastal ranges approaching so close to the sea precipitate in mists and dews the moisture of the ocean air. The alluvial soil is derived from the weathering of the coal-bearing rocks of the neighbourhood as well as various basaltic dykes, whereby it possesses great natural fertility. In depth it exceeds 15 feet of a friable, porous loam, supporting a rye-grass pasture of great luxuriance, and with a rank growth of clover, forming an ideal dairy-farm.

With the exception of one wet spot, draining has not been found necessary, but a ditch 6 feet deep in places has effected what was required to make good sound pasture. There is no need for conservation of water or of irrigation, but a large underground tank at the residence provides for household requirements, and there is also one at the dairy.

The fences are new, the external are of three rail, and the divisional of a top rail and five barb-wires. The pastures are divided into fourteen small paddocks, ranging from 2 to 12 acres, which the cattle take in daily rotation, camping at night on the hillside. There are six gates in all.

The homestead is of wood, built two years ago, containing ten rooms, fitted with every convenience, and standing in a pretty flower garden, central to the farm, and near by is the large vegetable garden and many fruit-trees, also a coach-house and stable. The farm steading is grouped about 200 yards distant, and consists of an old dwelling-house of slabs, lined throughout with match-boarding, and converted into an excellent dairy. This inner lining of match-boarding gives a spacious interior, kept spotlessly clean, and the large room is fitted with three tiers of stands for seventy-five tin pans. The windows are wire-lined, and a copious cross circulation of air is provided. The old kitchen fireplace is used to heat the cleansing water. Quite too close is the piggery, with paddocks and styes. The calf-pens have battened floors, which afford a very clean surface to lie on. There is a good-sized poultry-house, also a coach-house and stable, in which the implements are sheltered, and hay stored. The milking-shed is fitted with five bails, and has three large yards attached. Whitewash has been freely used, and the buildings as a whole present an unusually neat appearance.

The implements comprise two one-furrow ploughs, and an American one-furrow small plough, 1 iron horse-hoe and scarifier, set of four iron harrows, 1 pair medium, and 1 heavy wood harrow, wood roller, A.B.C. corn-sheller, corn mill (Richmond and Chandler), chaff-cutter (Bentall), mower (Hornsby), bullock dray, spring cart, buggy and sulky; also a large dairy plant. Repairs are done by tradesmen.

The rotation and system of cultivation is as follows:—The farm consists of 76½ acres of pasture, 16½ acres of arable land, a pig paddock of 8 acres, farm buildings, dairy, and residence, with orchard and garden, 2 acres, in all

103 acres. The $76\frac{1}{2}$ acres of pasture are divided into fourteen paddocks, and the $16\frac{1}{2}$ acres of arable into four fields, of which 2 acres are in lucerne, 10 acres in broadcast corn, 4 acres are planted with corn, and there is a half acre plot of potatoes. A small quantity of oats is grown for hay for use when the grass is too fresh, but very little dry fodder is required since the pastures never fail. The maize yields over 80 bushels per acre; lucerne gives six cuts per annum, potatoes do well, and some field peas are thrashed out for the poultry.

Beyond gathering the scrapings from the milking-yards, and keeping the fowl droppings for the garden, no manure is conserved, but on a dairy farm the animals fertilise the pastures direct, and where there is a largo pig paddock, as is the case here, the same also occurs.

Very little fodder has need to be conserved on a purely pasture farm. The management of the grass land is very instructive, and Mr. Gibson lays down grasses successfully. When he commenced to farm this property two years ago, the pastures were in a neglected condition, being covered with tussocks of hard, unedible grass. To eradicate these, the lea was ploughed, and maize, sorghum, or planter's friend were sown in the furrows, and either cut green or let ripen. After this was sown, barley, together with from 2 to 3 bushels of rye grass, and 10 lb. of clover. On the barley dying out, the rye grass and clover will be found to occupy the ground. It is the opinion of Mr. Gibson that rye grass wears out in this district in ten years, wherefore he renovates his pastures by taking a maize crop cut green followed by the above mixture of barley and grasses. Great pains are exercised to get good rye grass seed, hitherto the supply has been derived from the Kangaroo Valley and Broughton Creek, but last year a Sydney firm supplied an extremely clean-looking sample, with the result that all the pasture derived from it developed a thick yellow rust, whereas the old pasture adjoining was wholly free. The same rust has apparently appeared in other districts this season, and it is usually the case that by inadvertent channels, pests are introduced. Great pains are taken to hoe out weeds and tussocks, the pastures being continually gone over, and the debris burnt, for, without doing so, the grazing value would be seriously diminished.

The livestock comprise 4 horses, 98 cattle, 11 sheep, 51 swine, and 300 head of poultry. There were 2 plough and 2 buggy horses, but several horses were running on the leased land. The cattle comprise 72 milkers, 12 yearlings, 13 calves, and 1 bull. Mr. Gibson's experience is instructive as to the effect of continued breeding from a cross in dairy cattle. When at Dapto his dairy herd was pure "Major" stock, celebrated for size and yield of milk, Durham being the dominant type. About six years ago the fashion set in for Ayrshires, and Mr. Gibson purchased full-blooded bulls at fancy prices. The first cross were full of vigour, and mostly bulls, but when the first cross heifers were put to an Ayrshire bull, the progeny was stunted, with small teats, and altogether inferior. Mr. Gibson has abolished the Ayrshire, and is determined to build up again a "Major" herd, and now uses one of his own home-reared bulls, three years old, called by him "Major II." He is of a light roan colour, of a kindly disposition, and with points that will please a dairyman. Already his influence is shown in a large fall of heifer calves, large, robust, and with good coats. The "Major" strain is scarce enough, that bull having died eleven years ago, but now that the Ayrshire fancy is over, Mr. Gibson considers that the good old Illawarra type, with dominant Durham influence, is likely to retain its reputation without any further crossing experiments. A ready sale is found for springers at up to £10 per head, and each year £120 is derived from this

source. The cattle in milk number 72. They show the Ayrshire cross plainly, also a Jersey touch here and there, indicated by the yellow skin. Owing to early precocity from rich pasture, together with the carelessness of neighbours with regard to their bulls, several of the heifers in milk are less than two years old, and in consequence are also stunted in their growth, but may fill out ere their second calf is born. There were two "Major" cows, mother and daughter, each of which yield 5 gallons of milk per day five months after calving. Work in the dairy commences at 4 a.m., and in one and three-quarter hours the 72 cows are finished, the family mustering 5 milkers, each stripping 10 cows per hour, with a boy to carry the buckets to the dairy. Into each milk-pan a spoonful of "thick" milk is placed prior to pouring in, with a view of ripening the cream with certainty. At 4 p.m. the evening milking commences. The introduction of the factory system has displaced a large number of hand dairies, but by careful management, as good, if not better, butter, may be made. The possible liability of the factory system to inferiority is due to inability to control care and cleanliness on the part of the supplier, both with regard to the quality of the stock, their health, feed, and surroundings, also the production of an unvaried quality of milk, all of which the one proprietor has at command. He sees that the milk is treated under the best circumstances, and that the dairy utensils and water are clean. Moreover, whereas factories are worked by men, in a hand dairy women superintend, and are probably more particularly neat, exact, and clean. There are other appendages of good management to a home dairy in the better utilisation of skim milk, bearing of calves, and fattening of swine. Altogether, Mr. Gibson's dairy affords a successful instance of an old-fashioned dairy holding its own. The milk sets in from 24 to 26 hours, but if the weather be hot, sufficient ferments are deposited from the air without the spoonful of thick milk being first put in the pan. Churning is done in an 80-lb. Kiama churn, the butter being washed in it with two waters, and is next lifted out to drain all night on a tray, where it is salted, and next morning worked on a Bradford's rotatory table, and finally packed for market. The butter had a rich, natural colour, with good grain and a delicate taste, and has a reputation for keeping a long time without turning. The present production is 330 lb. per week from 72 cows, many being heifers, with their first calf. The cows calve without attention, and no losses occur. The calves are taken away the second day, and thenceforward fed on "thick" milk, on which they thrive, and soon learn to feed on the rich pasture. The butter is purchased by one dealer, whose connection lies with the miners. He pays the top price for dairy butter in Sydney on the day of sale, and accounts are settled weekly.

There were were 51 swine at the time of my visit, consisting of 1 boar, 9 breeding sows of a Poland-Berkshire cross, 32 pigs two months old, and 9 fattening three months old. The intention is to get a pure Berkshire boar, and eliminate the Poland-China strain. The young pigs are purchased by dealers for the Sydney market, at an average of 12 per month. Several are fattened for bacon, chiefly for home use.

A small flock of Southdown sheep were kept, consisting of 1 ram, 4 ewes, and 6 lambs, of a pure type and splendid condition, with a tendency on these rich pastures of attaining a great size. Sheep are extremely scarce in Illawarra, and these Southdowns are merely a fancy flock.

Poultry add considerably to the annual turn over. Bronze-wing and ordinary turkeys are reared to the extent of fifty per annum, also geese and ducks, many prizes being taken at local shows for all classes of poultry. Representatives of the following pure breeds are kept:—Spanish, White

Leghorn, Black Leghorn, White Hamburgh, Game (Australian and Duck-wing), and Plymouth Rocks. Thick milk is used as poultry food, and the fowls pick over the maize and oats, and run extensively over the farm, earning their own living without labour to the farmer.

Orchard fruit is sold, also surplus vegetables, the dealer taking what he wants, the kitchen garden being very productive and well attended.

Book-keeping is elementary, merely a record of sales and purchases being kept.

The labour of the farm is done by the family, the four daughters and son attending to the milking and dairy.

The subsidiary aids are:—Co-operative family labour; sales of springers, calves, pigs, and poultry; also orchard and garden produce.

The points of interest are:—Excellent pasture; the hoeing out of tussocks, and the mode of laying down grass; a pure dairy herd and Southdown sheep; the breeding of a large number of pigs; keeping of all varieties of poultry, many prizes being won; a model dairy on the hand system; marketing of produce to a dealer, who pays cash on the basis of Sydney prices.

The management, with a view to profit, is shown by the returns to be excellent. The farm is a freehold of 103 acres, costing, at £35 per acre, £3,605; the house, fencing, and improvements may be taken at £1,100, and the live stock at £900; in all, £5,605. The sales per annum are about £780, made up of—Dairy produce, £500; sales of cows and calves, £130; pigs, £100; poultry, £50; total, £780. In addition to which there are the household expenses of a family of seven persons. The management may be regarded as excellent, and the dairy a model one, on the old-fashioned system.

William Swan, The Meadows, Albion Park.

South Coast District.—Place, No. 10; points, 66·31 per cent.; arable, 35 acres; pasture, 124 acres; homestead, 1 acre; total, 160 acres.

(3 November, 1893.)

Mr. William Swan is a native of the Illawarra district, and has had a life-long experience in dairying. He is a tenant of the farm entered for competition, the first full term of three years having been completed, and one half of a second one has expired. This farm labours, therefore, under the disadvantage of a very short leasehold, without compensation for improvements. The rent is £2 per acre, paid half-yearly in advance, but as Mr. Swan added to the dwelling-house and put up divisional fencing, at a cost of £275, a rent of 50s. per acre in reality is arrived at. The land is the very pick of the famed Illawarra district, and is distant from Albion Park township about half-a-mile. It lies midway between the mountains and the ocean, each being 2½ miles away. The Macquarie River bounds the property, winding for over a mile, and watering every paddock. At flood-time the land may be submerged in places for a few hours, but the waters drain off at once from this flat, alluvial farm. There is very little shelter for live stock, but they lie, during winter nights, on the deeply-excavated sandy banks of the river. Milk is the chief product of the farm. That of the morning is sent to Sydney, *via* the Fresh Food and Ice Company, and the neighbouring Albion Park Butter Factory takes the surplus Sunday and evening milk. Springers, calves, and fattened culls are sold at good prices locally, the latter being sought by the butchers. The climate is all that could be desired, spring and later frosts are exceptional, and a drought merely serves to check the luxuriance of the grass, so that much preserved fodder is

unnecessary, for cattle will not touch hay when they can get pasture. Before settlement, cedars formed the chief tree, and a dense, luxuriant brush occupied this fertile ground. The banks of the Macquarie are 15 feet in depth, and probably as many more before bed rock is reached, the soil being a deep, porous, chocolate loam, with a limited area of sand and clay. Drainage has been necessary where some surface soakage lay in a depression, and a wide open ditch, 60 chains in length, is a success. In another paddock some deep furrows have also proved effectual, and are all that a short lease would warrant. Rain-water is conserved for household use, whilst wells, 15 feet in depth, will strike water anywhere. The fences are serviceable, generally two-rail, with a barb wire in many instances, which cattle quite understand. There are thirteen paddocks, from 3 to 35 acres in extent, and are grazed in routine order. The farm is under-stocked, so that the grass is nowhere eaten bare, whilst weeds and tussocks are carefully hoed out. Couch grass forms a proportion of the pastures, and the cattle leave it when they can get sweet young grass, but it serves as a stand-by for winter. The bulk of the herbage is made up of rye grass, prairie, and white clover, all of which grow with great luxuriance.

The residence consists of a six-room wooden cottage, erected by Mr. Swan, and the original slab dwelling-house with kitchen. There is a small flower garden in front, and the pasture extends up to the other sides. The farm buildings are of wood, and comprise a three-stalled stable and barn, five milking bails with yards, and a neat refrigerator shed for the milk before despatch by rail, erected at Mr. Swan's cost, fitted with tanks and Lawrence's cooler. Should a larger barn be at any time needed, the landlord allows the use of one that stands by the fence line.

The implements consist of a one-furrow wood beam bullock plough, a one-furrow iron plough, iron horse-hoe and scarifier, a wood-framed one, wooden harrow, "Prince" corn-sheller, four-wheel truck for drawing timber and green stuff, spring cart, and buggy. The milk refrigerating plant, including dairy cans, cost £65. A mower and roller are borrowed when required. Repairs are done by tradesmen.

The system of cultivation and rotation is as follows:—On entry, five years ago, Mr. Swan commenced to renovate the pastures by ploughing in the lea and taking a crop of maize, planter's friend, or imphie. The stubble is then ploughed in, a seed bed prepared, and the following mixture sown broadcast in March or April:—Rye grass, 1 bushel; prairie grass, 1 bushel; white clover, 1 lb., and oats may or may not be sown as well. About August the stock feed off the first growth, principally the oats, and by spring the new turf is firmly established, the growth being so rapid, and the paddock is browsed in rotation with the others. The 35 acres of arable land are cropped as follows:—Planter's friend, 12 acres; imphie, 5 acres; maize, 7 acres; oaten hay, 4 acres; potatoes, ½ acre. A paddock of 6½ acres of green oats was fed off during last winter, and is now kept as summer herbage. The maize sown in the furrow is hoed by horse and hand, and husked in the field, yielding 75 bushels per acre. This season "Pig Tooth" corn was sown from seed got two years ago from Berry. In past years "Hogan" yielded well. Out of the 500 bushels expected from this 7 acres, 100 bushels will be kept for the poultry, and the rest sold locally at from 3s. 6d. to 4s. per bushel. "Brownell's Beauty" was the potato planted on the ½-acre plot. The haulm looked well, and all tubers over home requirements will be sold. "Planter's Friend" is held in high repute as a cleaning crop for couch grass on arable land, which is starved into weakness by its dense growth. The 12 acres about to be planted will be cut green in May and through the winter. Last

year £25 was realised from sales of imphie seed, the best heads alone being taken, and 40 bushels of 60 lb. each were secured, which sold at from 20s. to 23s. each. Grass seeds are thrashed in some years to the extent of 80 bushels, which, on sieving, separate into 20 bushels of rye grass, worth 4s. per bushel, and 60 bushels of prairie, worth 3s. 9d. per bushel.

No system of manuring is pursued, the milking yards are cleaned up each week, and the gathered dung is made into manure for application to the ploughed land.

Fodder is not conserved to any extent, since pasture never fails, and cattle will not eat hay if they can get grass. Doubtless if a long lease were granted more of this fertile ground could be ploughed, and a larger number of stock kept.

The system of laying down grasses, already noted, is excellent.

The live stock are as follows:—7 horses, 110 cattle, and 150 head of poultry. There are 2 plough horses, and 5 for saddle or buggy. The dairy cattle form the leading feature, in that a more level lot of beautiful cows with deep frames and big udders cannot be met with. Pure Durhams and the "Major" strain predominate; here and there an Ayrshire touch is noticeable, and perhaps a Jersey cross. Their excellent condition and deep milking were remarkable;—the result of exceptionally good pasture. The cows must milk well or they are culled to be sold fat. Old cows are not kept, and with a due proportion of heifers coming on the herd is composed of milkers in their prime. Data is, unfortunately, not available as to the annual yield of any one cow; such records should be kept by every dairyman; but the buying of milk on its fat value by the factories will, doubtless, lead to complete entries of yield and richness being made. Fat in milk is a regular factor, not dependent on food or health, but peculiar to the individual; and, as Mr. Swan remarks, "thick blood makes thick cream," whilst the skill of dairy farming is to cull at once the old and inferior and to keep the cattle in equal condition all the year round. Mr. Swan's herd has established a reputation, whilst the rich pastures sustain the cattle in prime condition, and, in fact, many more could find food. There are 53 cows in milk, 17 dry cows, 35 yearlings, 1 bull, and 4 working bullocks; total, 110. When opportunity offers and grass is abundant likely cattle are purchased cheap for fattening. The milking is so arranged as to be in time to cart the cans to the Albion Park factory, whose van collects in one load for the station the milk of many suppliers, charging 3d. per can of 11 gallons for the service. The milk goes to the Sydney depôt of the Fresh Food and Ice Co., a fixed price of 6d. per gallon being given, but the morning's milk only is taken for six days in the week, whilst the local factory separates the evening; Sunday milk and surplus milk, returning an average of from 3½d. to 4d. per gallon, in proportion to the butter sold. The skim milk is returned, which, on this farm, cannot be done without for feeding calves. Household butter is purchased from the factory, none being made at home. No swine were kept. Poultry number 150 head, and return £60 per annum for produce sold locally, 35 dozen of eggs being gathered weekly. They are well fed, a portion of the maize crop being retained for their use.

There is neither garden nor orchard, and in book-keeping, sales and purchases are entered. The labour of the farm is done by Mr. Swan and four boys, who take the milking.

Subsidiary aids may be enumerated as co-operative family labour, sales of grass and imphie seeds, good prices for high-class springers and fat cattle, and the disposal of eggs and table fowls.

The points of interest are a splendid herd, high-class dairy stock, the method of renovating pastures, open ditch drainage, the saving of grass and imphie seed, and the erection of buildings on a short tenancy lease.

The management, with a view to profit, is based upon keeping the highest class of milkers upon renovated pastures of great fertility, with co-operative family labour, and marketing the milk through the Fresh Food and Ice Co. and a local factory. The difficulties entailed by a short lease are many, for instance, deficient accommodation had to be met by the tenant building at his own cost; there is neither garden nor orchard, and the system of letting farms by tender leads to a rental being too frequently offered that can leave no profit. Mr. Swan's great skill is shown in the management of his cattle, but it would not be fair to him to publish the results. Suffice it to say that the annual turn-over leaves a fair return on the capital invested after the rent of £2 10s. per acre is deducted. The farm affords an instructive example of stock of the highest quality being carried on pastures of great fertility, the produce being most favourably marketed, and the whole worked with the minimum of labour.

Haywood Brothers, Oaklands, Pambula.

South Coast District.—**Prize Farm; points, 88·31 per cent.; arable, 37½ acres; pasture, 71 acres; homestead, 7½ acres; orchard, 2 acres; wattle, 30 acres; uncleared, 37 acres; total, 184¾ acres.**

(14 November, 1893.)

"Oaklands" farm is less than a mile from Pambula township, and is distant 4 miles from the port of Merimbula, which is in steam communication with Sydney twice a week. The cultivated area of the farm occupies the alluvial flats of the Pambula River, which bounds the south side for a quarter of a mile. A portion is subject to flood, and it is exceptional if much damage results, whilst a useful deposit of silt would result. There are 68 acres of hillside, 30 acres of which, overgrown with wattle, are now undergoing clearing. Water never fails, although a dry year is felt by the herbage. The soil is extremely fertile, possessing somewhat the character of a black sandy loam of great depth, with a few wet spots, some of which have been drained on the underground system. The climate is tempered by proximity to the ocean, but is protected from its strong winds by an intervening range of low hills. In winter, however, cold winds sweep down from the Monaro table-land, and late frosts are common in spring, but do no serious harm. The geology of the district is not easy to decipher; there is a local sandstone, and the celebrated Pambula gold mines indicate a felsite, and even more complex formation, but as far as the farm is concerned, it is on a fertile alluvial flat. The property formed part of the original grant to Mr. W. Walker, then it became connected with Mr. James Manning, who was the immediate occupier prior to the late Mr. Haywood, who purchased it. This last-named gentleman died in 1889, and his three sons have since then undertaken the management. Each one supervises a different department, and their united intelligent labour accounts for so many subsidiary aids being successfully conducted, which have done so much towards winning the Champion Prize. The late Mr. Haywood first leased and then purchased the 184¾ acres in 1870. The price paid was £1,400, which included a costly residence, farm buildings, and cottages, so that a bargain was made. During his occupancy more buildings were erected, much land was cleared, and the fencing nearly wholly renewed. It is interesting to

note the magnificent oak-trees around the house, the flourishing mulberries, and Spanish walnut, also two large olive-trees, all of which serve to show how suitable the climate and soil are for their growth.

The land does not need much drainage. Some wet spots are sufficiently dried by open cuts, but others required timber and stone underground drains. Water conservation is not necessary, in that wells sunk anywhere afford an abundant supply. The fall of the river is such that water-power might be availed of at a moderate outlay, and the same race could be used to irrigate, save that the land seldom wants water.

The fences throughout are massive 4-rail, comparatively new, and in good order. There are five iron gates, twenty-eight other gates, and no slip-rails to the paddocks. Weeds are kept down along the fences. The paddocks vary in size from 2 to 27 acres, and are twelve in number.

The residence is of brick and stone, containing thirteen rooms, and was a very costly building, being erected by the Twofold Bay Pastoral Company, as one of their head stations. Behind it is the detached kitchen and offices. When occupied by the late Mr. James Manning, the gardens, in which he took great pride, were planted with many introduced trees. In front of the house there stand two olives 30 feet high, producing in abundance a small fruit, and one of the grand oak-trees has a trunk 5 feet in diameter, and last season's large crop of acorns of over 50 bushels was saved for the pigs. The farm buildings comprise a brick cottage, forming the dairy; a wooden barn, the upper portion of which is used as a fodder store, and implements are housed below, where also the food-preparing machinery is placed, and worked by an adjacent horse-gear. Another building contains a large bacon-smoking chamber, carpenter's shop, and forge. The piggeries comprise a range of styes having wood floors. A wood standing-floor is put on either side of the troughs, which are made out of hollowed trunks. There are four milking-bails, with exit doors at the head. The pig-killing yard is fitted with an overhead tram, on which a travelling hook runs, to which the carcass is suspended. The scalding tank is a 6 feet length of a boiler shell cut in half and forming a cheap tank such as no farm should be without. Into this tank the carcass is lowered, and is then carried in suspension to the cooling room. There is, furthermore, a buggy house, pig yard for fattening on separated milk, and a slaughter yard for oxen, also sundry poultry houses. The whole forms an extensive, complete, and serviceable farmyard kept in good order.

The implements are as follows:—One one-furrow (Hornsby), one one-furrow chilled digging plough (Howard), one two-furrow plough; two sets iron harrows; heavy triangular drag-harrow (home-made); disc harrow; "Planet" horse hoe; "Planet Jr." garden-sower; two horse-hoes and scarifiers; wooden roller; hay-rake (Howard); combined mower and reaper (Hornsby); cornstalk-rake (home-made); "Farmer's Friend" corn-drill; "Veteran" cornsheller and bagger; winnower (Hornsby); large chaff and bark cutter, by Locock and Barr, of Shrewsbury; horse-works; dairy complete with Laval's horizontal hand-separator and 80-lb. Kiama churn; honey and bee plant, including Cowan's "Rapid Reversible" extractor; two drays, spring-cart, buggy, and waggonette; also a complete smith's and carpenter's shop for doing all repairs at home.

The system of cultivation is to crop the arable land to the full. The 37½ acres are divided as follows:—Cereals—Maize, 19 acres; wheat, 2 acres; buckwheat, 1 acre; in all, 22 acres. Fodder crops—Oats, 2¾ acres; barley, 2 acres; vetches, ¾ acre; "Planter's Friend," 1½ acre; potatoes, 8½ acres; total, 37½ acres. The vegetable garden occupies 2 acres; orchard, 5 acres;

homestead, 2¼ acres; pasture land and swamp, 71 acres; wattle plantation 30 acres; uncleared land, 37 acres; total, 184¾ acres.

Land for maize is worked fine and clean before sowing; the corn is drilled by the "Farmer's Friend," which has a manure-box attached, and is kept clean by the "Planet" horsehoe, which also hills up; husking is done in the field; the cores are thrown as litter to the pigs or used as fuel, and the stalks are either ploughed in, using a disc coulter on the digging plough, or are carted to rot in a heap. The varieties sown were "Red Pip," "White Cardigan," which gives a most satisfactory yield, "Red Hogan," and a cross with it and the "White Hogan." In some cases maize is fed off by turning pigs in, but the local price of corn is now too good. The 19 acres should return close on 1,000 bushels, for the yield generally averages 50 bushels per acre. In past years maize from this farm was sold to Munn's Maizena Co., and the late Mr. Haywood obtained a certificate for maize at the Melbourne Centennial Exhibition of 1889.

Potatoes do remarkably well, and from their luxuriant foliage this season as much as 10 tons per acre may be got from the 8½ acres. Messrs. Haywood Brothers have initiated a novel method of planting, having noticed that if the sets be placed beneath the natural surface of the ground the land becomes hard, wherefore the rows are marked out and the sets are placed on the ground. Next, the "Planet" horsehoe, fitted with mould-boards, hills up and covers the potatoes. Later on, the first horse hoeing gives an additional hill up, which is repeated until the haulms are too high for further tillage. The "Planet" is used to throw out the potatoes, or they are forked by hand. The varieties planted were "Early Rose," from seed obtained from Geelong, and giving capital new potatoes twelve weeks after planting; "Brownell's Beauty," from local seed; and "Circular Head," from Hobart seed. All were doing well, the seed seldom missing.

There was an interesting experimental plot of wheat occupying 2 acres, which, on the date of my visit, showed no rust. A bearded wheat grew well on ½-acre plot, and will prove profitable for poultry feed. The seed was furnished by the Department of Agriculture, and was known as "Gallant's Hybrid," a prize-taker at the Inverell Show, and is said to be rust-resistant. There were 1½ acres sown with Leak's rust-resistant wheat, and smaller lots of a dozen other varieties.

Oats to the extent of 2¾ acres are grown for hay, yielding 3 tons per acre, and 2 acres of barley for green feed, timed to come in just before the winter, and to last right through. The wise provision is made of having a stack of hay always kept as a stand-by against scarcity of feed for the dairy herd. "Planter's Friend" gives the most luxuriant green feed for fattening pigs, and is used to supplement the separated milk; 1½ acres were planted with it. Barley and vetches sown together to the extent of ¾ acres are also used for the same purpose. In order to feed the poultry, a trial is being made this season of Japanese buckwheat, 1 acre being sown broadcast, and the plants were coming thickly up at the time of my visit. Frequently two crops are got off the same ground in one year; for instance, potatoes planted in November will be followed by swedes in March, or "Planter's Friend" in February by wheat which is harvested in December. No fixed rotation is pursued. Maize is the main crop. Land that has been cropped for years is laid down with grasses for a rest, being sown with a mixture of rye-grass, prairie, and cocksfoot. Numerous small breadths of paying crops are grown, and clean cultivation is the rule. The yields throughout are large—maize up to 70 bushels per acre, potatoes from 5 to 10 tons per acre, and oaten hay 3 tons per acre.

No system of manuring is pursued. The river overflows now and again, leaving a deposit, and maize-stalks are ploughed in or rotted for application to poorer land. Farm-yard manure is got from the sweepings of the stables, milking, pig, and slaughter yards. Poultry-droppings are put aside for special dressings, and in past years several hundred tons of lagoon mud have been applied to poor pasture. An experimental application of nitrate of soda to a row of potatoes on rich soil showed no advantage over unmanured.

Fodder is conserved for hay, 2¼ acres of oats and 2 acres of barley being grown. The crop is cut by the mower, and stacked in the farm-yard, close to where the chaff-cutter is placed, so that it may be readily chaffed by horse-power, a large proportion being sold locally. Ensilage has not as yet been tried, but Mr. Haywood is considering the matter.

The laying down of grass-land is carefully attended to, cleanness of the land being made a prime consideration. Maize is generally the prior crop, and a mixture of seeds is sown, consisting of rye-grass, prairie, and cocksfoot. These grasses grow quickly, and are soon established. An acre of cocksfoot has also been reserved for seed.

The live stock comprise 10 horses, 81 cattle, 25 swine, and 300 head of poultry. There are 2 plough-horses, one being a breeding mare, 2 coach-horses, one a breeding mare, 2 saddle-horses, and 4 young horses. All the animals were of a good type, the coaching-horses verging on a large size. Thirty cows are milked, besides which there are 10 springers, 30 young cattle, and 10 stores fattening; in all, 80 head. The dairy cattle are the usual South Coast type, with some Durham cows, the bull in use being a Devon, and the next sire is to be a Durham, so as to introduce a change of blood. The Devon bull was a very beautiful animal, typical of the breed, and quite worthy of admiration. His influence on the herd has been, without doubt, good in that the breed is noted for rich milk and great powers of keeping in condition, besides which it is now understood that the Ayrshire breed owed its origin to a cross between the Jersey and Devon. Heifer calves from good milkers are kept for the herd, and bull-calves are either sold for veal at eight weeks old, or are reared for three-year-old fat bullocks. The young and dry stock are run on neighbouring Government lands.

Sheep are bought for home use, chiefly cross-breeds from the Monaro tableland.

Pigs are bred for fattening and bacon-curing, for which the farm has a great reputation, the late Mr. Haywood gaining a certificate at the Melbourne International Exhibition of 1889, besides numerous prizes in this Colony. The improved Berkshire is kept, there being 5 breeding sows and 20 stores. The range of breeding-pens are well designed, being large, and floored with wood. The pigs do well on separated skim-milk, supplemented with green fodder, such as Planters' Friend or vetches, fed to them in the yard. Over 100 per annum are bred and fattened, and from 100 to 200 additional are purchased fat during winter, when the curing of bacon takes place. The H4 brand of bacon is well known in the market, and sells at a full price, 7d. per lb. being realised. The dry salt and sugar method is pursued, every care being taken to make a good article. The smoking chamber is very large, and the smoke is made from corn-cores, with sawdust or wood chips heaped on to smother the flames. Rolled bacon fetches 9d. per lb., and hams from 8d. to 9d. The fixing of a portion of an old steam-boiler as a scalding-tank has already been noticed. It is used also for boiling potatoes and all manner of vegetables. Pigs do well on boiled food, and a vessel of this description forms a very cheap and useful adjunct on a farm. Many thousand dozen of eggs are sent to Sydney, packed in patent

cases. Several breeds and crosses compose the bulk of the 300 birds that are kept. Leghorns are, however, cherished, because of their laying propensities, and Plymouth Rocks come next in favour. A few ducks and turkeys are kept, but no geese. Skim-milk is fed to the poultry, and special feed grains are grown, such as Cape barley, buckwheat, turnips, and mangold. The eggs from this farm fetch the highest price for South Coast eggs in the Sydney market, and the management aims at getting layers during January, February, and March.

Bee-keeping is made a special feature, there being thirty-three hives of Italian, hybrids, and English, occupying a large grass plot adjoining the residence, with provision for as many more hives. The boxes are made at home, and fitted with frames on the Langstroth system. Hoffman's self-spacing frames are highly approved of. The promise of honey this season is exceedingly good, and a ready sale is made locally. Full sheets of foundation are always used. Queens are raised at home, and a project is entertained of placing several pure nursery hives for queen-rearing on Montague Island, a few miles distant, where there would be no chance of intermixture with other bees.

When mining at Pambula was in full swing a year or so ago, there was a great demand for market garden produce, and milk was delivered twice daily. There is no such trade now, but 2 acres of good land are this season set apart and planted with all sorts of kitchen vegetables, for which there is a good local sale, besides numerous sorts for seeds, whilst some of the produce is used for the poultry.

In this garden the "Planet, jun." seeder is used. Amongst the sales of seeds made last year, sunflower fetched 7d. per lb.; buckwheat from 7s. to 12s. per bushel; planters' friend, parsley, mangold, turnips, melons, pumpkins, &c., also winter vetches, at 8s. per bushel; sorghum, 50 bushels, at 4d. per lb.; and potatoes. Nursery stock was also dealt in, over 2,000 fruit trees having been sold.

The original orchard has disappeared through age, but young trees have replaced the ancients, and, in some instances, vigorous trunks of useless varieties have been crown grafted with choice bearers; for instance, a Shropshire Damsel, which sheds its fruit each year, has been grafted with an Orleans plum; also the Five-crown Pippin in preference to other apples, since it does best at Pambula. The fruit is sold locally.

The dairy is furnished with a Laval horizontal hand separator, and the cream is churned in an 80-lb. Kiama. So successful is the result that Mr. Haywood intends to enlarge the plant, and drive it by power, whether steam or water has yet to be determined. The increased quantity of milk will be looked for from neighbours. The skim milk is given to the pigs and poultry, and is supplemented with green food, such as planter's friend, vetches, &c. When the Pambula mines were fully working a delivery of milk was made daily, at very profitable rates. This and the demand for vegetables swelled the annual turn over that year to £1,200. The butter is all sold locally at top Sydney rates.

The wattle grows to perfection in this district, and has spread over ringbarked hillsides. A contract has been let for clearing 30 acres of such country, £5 being paid in money, and the bark, the property of the contractors, to be carted free to Merimbula. The fallen timber is to be burnt off, and the stumps got out. This waste area under wattle has so grown into value as to pay for the cost of being made into good farming land.

The book-keeping is elementary, purchases and sales being entered. The labour of the farm is done by the three brothers and two hired men.

The subsidiary aids are co-operative labour, sales of seeds, both vegetable, grass, and farm, as well as nursery stock; also eggs and table fowls, dairy, fruit, and garden produce, sales of bark, bacon-curing, bee culture, hire of horses, implements, such as the corn-drill, the reaper at 6s. per acre (horses and labour being found as well), cutting bark for hire, letting out vehicles, home repairs (both smith and carpentry).

The general management, with a view to profit, is to utilise the local market and send all surplus produce to Sydney. Quality is aimed at, and, in consequence, dairy produce, butter, bacon, and eggs, fetch top prices. Numerous subsidiary aids swell the turn over. The land is carefully cropped, and the most made of it. The soil is fertile and well watered. Two crops and catch crops are taken whenever possible. The hand separator has been so successful that it is intended to replace it with a steam plant and purchase milk from neighbours. The largest turn over in any one year amounted to £1,200, which was made when the Pambula diggings were in full swing. Last year the total was £800. The original outlay in the purchase of this property was £1,400, but a large sum has been expended during the course of years in improvements.

Hugh McLachlan, Laurel Bank, Grafton.

North Coast District.—Place No. 5; points, 80·38 per cent.; arable, 26 acres; pasture, 30 acres; homestead, ¾ acre; orchard, ¼ acre; total, 37 acres.

(30 November, 1893.)

Mr. McLachlan purchased Laurel Bank in the year 1862, and has farmed and resided on it ever since. Until 27 years of age he had assisted his father, who was a practical Scotch farmer that had settled in the Grafton district in 1858, so that Mr. McLachlan learnt agriculture under one who had farmed in the old country. The land when first entered upon was a mass of dense scrub and timber, with about 30 acres cleared, abutting on a lagoon, and used now as pasture, because it is wet. Neither tree nor stump are to be seen anywhere on the 27 acres of arable land, and the soil may be ploughed 20 inches deep without meeting with a root. The price of land was higher thirty years ago than to-day, since it then cost £4 per acre of wet land and £22 10s. for the very best unimproved, whereas the present price would be about £20 per acre all round, including improvements, but this fall is due to the fear of floods. Last March the Grafton district was devastated with an inundation that overflowed all crops, leaving them a putrid mass of vegetation, and again in June the waters prevailed with a great destruction of live stock. The recuperative powers of the district are, however, wonderful, and there is now very little to show that ever such floods occurred. After twelve years of farming, an adjoining 171 acres were purchased out of profits derived from cultivating 27 acres, raising the total occupation to 228 acres, but this new portion was under lease to a tenant up to the end of last year, on expiry of which Mr. McLachlan determined to work the land himself. Since this competition was deferred from 1892, the prior entry of 57 acres has alone been judged, and allowance made for the extra live stock and implements.

The difficulties that confront the Clarence River farmer are many. The semi-tropical climate induces a most rapid growth of weeds, and is conducive to numerous insect and fungoid pests. The greatest drawback, however, is the liability to floods, but they are not an unmixed evil, in that the vast bulk is slowly moving water, depositing silt and renovating continuously cropped soils. The river is navigable for 60 miles to ocean steamers, and is 800

yards wide by Grafton, flowing between banks of alluvial soil exceeding 20 feet in depth. The waters are tidal, and great floods usually occur when with a heavy rainfall on the extensive water-shed there blows an inshore gale with heavy sea at the heads, keeping back the swollen waters. Much damage at these times is done by the slipping away of the banks, caused not so much by the scour of the river but by the overflow and swamp waters at the back standing at a higher level and percolating through into a falling stream. It is impossible for an individual farmer to drain such swamps on his own land, for the scheme would have to be an extensive one, and come under the control of a district board.

The soil at Laurel Bank is a fine, impalpable powder, without grit or stone, and at the highest point on the river bank is over 20 feet in depth. No soil can be easier to work, horses cannot poach it, and soon after wet implements can till it, yet heavy rains knock tiny clods into a hard, flat, tile-like surface. A horse-hoeing that has just thrown all weeds to the surface will be rendered useless by a passing thunder shower burying them again under this flat surface. The soil cannot be regarded as so very rich in itself. It is the vast bulk that constitutes its fertility, and this can be accounted for when it is considered that the greater part of the water-shed is granite country. The sudden rises of the river, when, without a drop of local rain; it is up 8 feet of a night, are due to the non-absorptive character of the granite mountain ranges, distant 60 miles inland, forming the water-shed, with the old silurian slates that are met with in the foothills, giving a tumbled country with many valleys, and towards the Upper Clarence sandstones overlying the coal. The weathered debris of these various rocks are carried towards the ocean, the coarser particles and sands being first deposited, and the finer silts finally form the rich soils of the lower reaches of the river. These Clarence soils may be depended on for two crops a year, and Sydney is the one market. Water carriage serves nearly every farm. Droughers can come alongside nearly every field, and from them transhipment is made to the ocean boat which reaches Sydney in thirty-two hours from Grafton. The small screw steamers that carry passengers create a short, sharp wash that does much to corrode the banks, especially where the protecting fringe of weeds has been injured by droughers, and to prevent this Mr. McLachlan has pitched his banks with 200 tons of stone. The facilities offered by water carriage enable the Grafton farmers to grow sugar-cane for the great mill down the river, and when ripe the company sends its own droughers and gang of cutters, paying 12s. per ton for the cane; and as 40 tons may be grown to the acre, a large profit is realised. The farmers on the lower river grow cane continuously for many years, despite the increasing sickness of the land, and no wonder then that rust, worms, and gumming compel resort to a rotation of crops. The growers on the Upper Clarence, not possessing such rich land, and only of late years recommencing cane culture, make sugar-cane an alternative crop with maize, and would probably take off one or two crops of potatoes before replanting cane. In any rotation a nitrogen gathering legume should occupy the leading place, but the difficulty to a Clarence farmer is to find for it a profitable use.* Perhaps to rest the land under rye grass and clover would be an excellent method were it not that risk of flood renders dairying too uncertain in that cows compelled to take refuge on distant ridges will be

* Cow-pea (*Vigna catiang*) has been recommended, sown at the rate of 5 lb. to the acre, and producing a yield of 30 bushels, or the weight of green fodder would be 10 tons in about four months' growth.

injured through neglect of milking. There are, however, several butter factories in the district.

On soils so porous there is no need for underground draining. Rain water is conserved in a cement tank for household use, and there are wells in two paddocks fitted with pumps. The fences were of two-rail, substantial, and kept in repair, there being a large supply at hand of posts and rails. Both gates and slip-rails are in use.

The homestead is on the bank and within a few yards of the edge, since the highest ground is by the river. The dwelling-house is of brick, and contains seven rooms, the kitchen and offices occupying the original slab cottage, which Mr. M'Lachlan built on his entry. There is a pretty flower-garden between the house and the water, and a good view is gained up and down the river. The warm climate calls for no extensive shelter for stock, so there are no stables proper, but the plough-horses are fed at midday in unroofed stalls, and green fodder is thrown into a long railed-off strip, 4 feet wide, between the ordinary fence and a low one, so as to prevent dirtying by trampling. The barn is of slabs, 36 feet by 20 feet, with a lean-to buggy-house at one end. The floor of the barn is on posts, and the rafter space is utilised for fodder storage. In the barn, potatoes and maize are prepared for market, the corn-sheller being driven by horse-power. There are three pig-styes near by, having sides of rails and palings, yards of earth, and sleeping-floors of wood, covered by a roof of iron. There is a cart-shed, and two unroofed milking-bails, whilst a separate slab shed serves for a carpenter's shop and smithy.

All implements are put under shelter as soon as done with. Those used for cultivation comprise two one-furrow, one two-furrow, two hilling, and a single-furrow gang plough, by Gilpin, an American model, costing £17, which does excellent work, particularly in covering in rubbish. The ordinary iron ploughs are of local make; and the double-furrow, by M'Diarmid and Scott, of Grafton, is highly spoken of. The hilling plough is fitted with handles that can be clamped at an angle so as to avoid damage to maize-plants when ploughing in close to a row. The roller and harrows are of wood, and of home make, also the A-shaped horse hoes and scarifiers, with short plough-handles. Mr. M'Lachlan has had a second A-frame added, giving more tines. To another, a strong horizontal knife, set to cut the whole width, takes the place of the the hindermost row of tines, but the tendency of the soil to a tile-like smoothness after rain prevents the extended use of an implement that is well designed to kill weeds. The "Planet Jr." horse-hoe is highly approved. The maize-stalk-chopper, by M'Diarmid, takes two horses to work, and consists of eight 40-inch knives, bolted to octagonal iron frames 20 inches in diameter. Its cost was £15. In the barn there are the chaff-cutter (Ashby), worked by the horse-gear (Picksley, Sims, & Co.), and the corn-sheller and bagger (Sim, of Morpeth), costing £15, and fitted with an elevator to deliver cobs to cart, bin, or upper floor; an addition suggested by Mr. M'Lachlan's brother, and not in common use. In order to protect seed-corn from weevil a zinc-lined case, holding two bags of maize, is fitted with a screw-fastened manhole for filling, and a 2-inch screwed plug for emptying, an arrangement that can easily be devised. There are the necessary appliances for a small dairy; small corn-cracker, corn-sheller, platform scales, wheelbarrow, horse-slide for green fodder, drill-marker, cart, buggy, and sulky. Light repairs are done at home, there being a forge and carpenter's shop.

The system of cultivation is to alternate maize with cane; a small area of potatoes are grown, also a little oaten hay for home use. Of the 27 acres under cultivation, 7 acres are in cane, 15½ acres in maize, 3 acres in potatoes

(to be followed at once by corn), half-acre in lucerne, and 1 acre occupied by the homestead. There are 30 acres of pasture, completing the total of 57 acres entered for competition. Particular care is taken to thoroughly clean the land prior to planting, three ploughings being preferred to scarifying afterwards, so as to bury the weeds, rather than risk a thunder-shower restarting them after being brought to the surface by the hoe. The cultivation of maize and cane has much in common. The corn is dropped by hand in a furrow, at 54-inch intervals. The cane sets are buried at the intersection of cross-furrows, the same distances apart. Both are frequently hoed, using the "Planet" or "A" scarifiers, and then chipping by hand. Hilling the corn is done by the single-furrow special plough already noticed. The varieties of maize sown are Hogan, Dent, and a large yellow corn, which is planted early in November, and ripens later than Hogan's. Blight is prevalent in the district, and some farmers who, after the flood, purchased seed-corn from Tumut were disappointed that change of seed from a colder climate did not obviate the liability to rust. But the cause probably lies nearer home. Fortunately, the corn on Laurel Bank farm was quite free from blight at the time of my visit. It was of a particularly luxuriant green, and some of it tasselling, promising a yield up (if rain fell when wanted) to 60 bushels per acre. The maize is husked in the barn, and the stalks chopped and ploughed in. After shelling and bagging, droughers approach the bank and convey the corn to the ocean steamer. Commission, freight to Sydney, and all charges are reckoned at 6d. per bushel.

Four varieties of cane are grown, the bulk being Mauritius ribbon, whilst Daniel Dupont, Singapore, and Fiji Rapphoe are being tried. Cane planted in September is cut first in from eighteen to twenty-four months' time. The yield is very weighty, from 40 tons per acre and upwards, the canes being cut below the lowest node, and topped below the nodes from whence the leaves spring, so that the pieces may be from 2 to 10 feet in length. The contract price is 12s. per ton, with an additional 1s. allowed, if carted to the river bank. Late frosts constitute a danger to all crops, in that a warm sun bursts the frost-bound tissues. The trash is, by careless farmers, burnt off the canes, but the Colonial Sugar Company insists on its being stripped by hand, and some farmers wisely burn it after the cane is cut, in order to destroy pests.

Potatoes do admirably on the Clarence, the first crop being planted in March, and harvested in July. The second one is put in during August, and lifted in November. The Sydney market is carefully watched, but it does not do to store potatoes in so warm a climate, and frequently the November crop grows in the ground, if digging be delayed. Should there be a glut in Sydney, the alternative is to feed the crop to pigs, rather than ship at a loss. Pumpkins are grown between the corn for home use.

Notwithstanding the silt deposits the Grafton soils can do with manure, and the local Ramornie Meat-works offers fertiliser cheap enough, because, unfortunately, there is no great demand. The alluvial farmers keep but few live-stock, and so make little farm-yard dung. Mr. M'Lachlan supplements what manure he can get from the piggeries with gatherings of rubbish and stalks, if the latter be not ploughed in.

A small quantity of fodder is needed for the live-stock, about an acre being cropped with oats for hay; they are cut by the scythe, and stored in a loft out of reach of floods. Grasses are not laid down, the water-couch coming up spontaneously on the 30 acres kept for pasture, because too wet for tillage. Buffalo-grass grows well, and couch forms the mainstay of the pasture where it is fairly dry.

The live-stock comprise 11 horses, 30 cattle, 2 swine, and 200 head of poultry. There are nine heavy draught horses of an excellent type of Clydesdale, these and the implements serving for the complete area of 228 acres. Mr. William Small, of Swan Creek, imported Clydesdales direct, and twenty years ago many of the late Andrew Town's stock were introduced to the Clarence, being purchased at full figures for breeding, but since New Zealand sent over so many good horses the prices have fallen, so that from £16 to £22 will purchase the best class. There are also a pair of buggy horses, of a small, useful, thick-set type.

The cattle number 30, and consist of 2 milch-cows for household use, 8 cows with calves running with them, 1 bull, and 19 steers, yearlings, &c., a few cattle being bred in order to utilise the feed on the wet pasture, and are sold fat.

Not many swine are kept, two pigs being killed annually for home use. The one breeding sow was Poland China. One store was fattening, and others are purchased, if need be, to use up the waste potatoes and inferior maize.

About 200 head of poultry, including some Muscovy and common ducks, are kept, and itinerant dealers barter goods for eggs, table-birds, butter, and other minor products. This method is pursued on all the North Coast rivers, and offers a very great convenience to the farmers. If, however, the balance be in favour of the producer at the end of the quarter, he gets no cash, but the credit is carried over, and a man with a large family can possibly keep pace with the barter. Now that butter-factories are being established, they might arrange to collect eggs and fowls and forward sizable lots to Sydney. If the birds were appraised at a moderate figure by the manager when sent in, they could then be sorted into prime, seconds, and inferior, and the credit balance on receipt of account sales for the month be divided *pro rata.*

A small patch in a field grows the vegetables needed for household use. In the small orchard near the house there were growing bananas, pineapples, citrus-trees, apples, pears, and quinces. Pines are not profitable, and the larger fruit-trees appeared to be suffering from root-decay, possibly an after-effect of the recent floods.

Bookkeeping is represented by entries of sales and purchases. The labour is compassed by Mr. M'Lachlan and his son. A hired man is kept for the new farm, and additional labour is got when required.

The subsidiary aids may be enumerated as co-operative family labour, sales of seed, corn, and sugar sets, light repairs, and the barter for household requisites of butter, eggs, and table-birds.

The points of interest were sugar-cane culture and growth of varieties of cane, excellent maize, thorough tilth and cleaning of the land, ease of shipment, good type of horse, and a commodious residence, and 171 acres of additional land paid for out of the profits of 27 acres of arable land.

The general management with a view to profit is based on maize, sugar-cane, and potatoes, grown with regard to thorough cleanness of the land. The labour-bill is kept down, while powerful horses and good implements enable the tillage to be well done. The marketing of the maize and potatoes is effected through agents, and a contract with the Colonial Sugar Company ensures a certain price for the cane over a term of years. The maize is grown from carefully-selected home-raised seed, so with the potatoes, and the culture of three varieties of cane other than Mauritius is experimental. Owing to so many successive floods and the loss of crops more or less, during the past five years, it was not possible to quote any figures representing the annual turnover of the farm.

Joseph Wass Johnson, Lowlands, Upper Southgate, Clarence River.

North Coast District.—Place, No. 4; points, 81·05 per cent.; arable, 40 acres; pasture, 12½ acres; homestead, ½ acre; total, 53 acres.

(1 December, 1893.)

This farm is situated on the banks of an arm, parallel with, and 200 yards distant from, the main stream of the Clarence. Shallow craft can navigate this creek, loading corn off the homestead, and in flood time it serves as a get away for the waters. It is, moreover, full of fish, and many a duck looses it head in the jaws of a giant eel, wherefore Muscovies, which care not for water are preferred. Public roads traverse the numerous high banks of the district leading to the farms, whose homesteads are generally next the stream, and in Mr. Johnson's case, the traffic is merely that of neighbours. Lowlands Farm is not naturally so fertile as others in the neighbourhood, but superior skill in cultivation is quickly seen. It was managed by Mr. Johnson when the property of his brother, until sold at a good figure to a gentleman, who put up superior buildings, a first-class residence, and made numerous improvements, including several acres of underground pipe-drains. Mr. J. W. Johnson still continued to manage, and on the death of the proprietor, obtained a lease. The property meantime was sold for £1,050, although its auction price a few years ago was £2,650, and large sums had since been spent on improvements, but this shrinkage was due to the fear of floods. This farm, therefore, occupies the position of a leasehold in the present competition. The soil is a deep, friable, sandy alluvial, subject to flood, the waters standing 5 feet over the highest spot, and necessitating arrangements being made for a speedy exit on the part of the occupier, who may find himself in the midst of a sea in a few hours, and have to swim his live stock for a mile to ground beyond flood level.

With water so plentiful, there is no need for its conservation, and stock are provided in the homestead with a large tank put in at the tenant's cost, and filled by a pump from the creek. When Mr. Johnson's brother had the property, he went in for cane, and drained, with 2-inch pipes 44 yards apart, 30 acres of wet land, only fit then for pasture, but now a fertile arable area. Surface drainage had also been attended to by running shallow ditches to enable rain-water to get quickly away. There were some rushes in the paddocks, but they were seeded by the floods.

The fences are substantial, and in good repair. In order to keep down weeds, a division fence between two fields of cane has, by consent of a neighbour, been taken down to their mutual benefit, since more ground is cropped, there being neither headlands nor weeds. One of the features of this farm is the eradication of standing weeds, and the destruction of seedlings by repeated horse-hoeing and scarifying.

The homestead is situated on the high bank of the creek, and consists of a superior weatherboard cottage, containing three rooms and dairy, with flower and fruit garden in front. A kitchen cottage of nearly equal size is at the back, and close by there is the bath and harness room. The coach-house is used as a store for new farm implements. There is a four-stall stable of slabs for the farm horses, and a detached two-bail milking-shed. The barn is particularly well built, and is also used for new farm implements. Mr. Johnson came from Lincolnshire some six years ago, and when in England was the winner of many ploughing matches. He was friendly with Cooke and Sons, plough makers, of Lincoln, and has represented them as an agent in the Grafton district. On the side of the farm-yard opposite the stables extends a long row of pigstyes, extremely neat and clean. There are eight styes fenced by palings, with a continuous iron roof, the yards and

sleeping floors being of wood slabs. Close to the piggery are a neat workshop and poultry-house, also a mid-day manger.

The implements are particularly good, those by Cooke predominating, and it is only by a wise selection that Mr. Johnson can till so large an area single handed. The double-furrow gang plough by Cooke costing £16, can complete 3 acres with three horses in a working day of eight hours, and this because the driver rides, whereby the horses are urged faster. When fitted with disc coulters it cuts up and buries the maize stalks effectively. Two of Cooke's single-furrow ploughs are also used, fitted with wood beams, disc coulters and digging mould-boards. To each of these, as well as to a double mould-board, can a "seed-sower" be attached at a cost of 15s., which Mr. Johnson considers is able to deal with maize with as much certainty as an American corn planter, besides saving an extra man and horse. Few farmers appear to recognise the value of a double mould-board plough. In Mr. Johnson's hands it plants cane and potatoes, making one traverse whereas a single furrow needs two. It can throw up a deep furrow in the centre of the rows of corn; take away the mould-boards, and place on a broad web-foot, and as a horse-hoe it cuts the weeds off perfectly. Replace the mould-boards with a potato body, and the tubers can be split out at a much less cost than by hand digging. The large 20-inch skeath or disc coulters fitted to Cooke's ploughs generally cut up maize stalks quite as well as a special chopper, drawn by a pair of horses. Cooke's chisel-tined iron drag harrows are an improvement on the wood-framed implements in general use. They can be worked in pairs, or singly by one horse, when the twelve chisel points do excellent scarifying between the rows of corn or cane, the handles being of assistance to free the tines from weeds. Cooke's expanding horse-hoe is of a better pattern than the A-shaped wooden ones, which do not open out, or the iron ones, made by many country smiths. It can be more widely expanded, has nine tines to which hoe-blades can be attached, so covering every inch of a 5-foot row. In comparison with the "Planet" horse-hoe, which Mr. Johnson works, it is twice the weight—160 lb.—and therefore does not jump about, nor does it skip the weeds. The other implements are a set of iron chisel tooth harrows by Page, of Bedford, wood harrows, wood roller, wheelbarrow, slide for green corn, platform, "Fairbank" scales and dray. In the barn there is a large maize-sheller, "The Farmer," which cleans and bags 60 bushels per hour, power being transmittted from horse-gear by Picksley, which also works a chaff-cutter and corn-cracker, both by Richmond and Chandler, as well as a circular-saw. Light repairs are done at home, there being a complete workshop. The necessary appliances for a small hand-dairy complete the list.

The principal crops are maize, cane, and potatoes, in the following proportions;—Cane, 11 acres; maize, 20 acres; potatoes, 4 acres; oats for fodder, 2 acres; barley, 1 acre; sorghum, ½ acre; water-melons, ½ acre; total, 40 acres arable; 12½ acres grass land; ½ acre homestead; in all, 53 acres. Maize and corn are tilled on similar lines as to preliminary cleanliness, and keeping down weeds during growth. The usual Clarence method of planting corn in rows 54 inches apart is pursued, but, with a view of getting more air and of scarifying four ways, Mr. Johnson has introduced the 42-inch square planting, dropping the seed by hand where the furrows intersect. Maize is husked in the barn, and taken by drougher to the Sydney steamer, freight costing 12s. per ton and other charges 8s., so that 20s. per ton is the full cost of marketing.

Cane is cut at a cost of 2s. per ton by hands employed by the grower, who personally sees that none is wasted, whereas the independence and

carelessness of the gangs sent by purchasing companies has been a frequent source of complaint in the past. Messrs. Boothy and Leeson, whose mill is adjacent to the farm, purchase the cane at 12s. per ton. In many cases, firing the cane to get rid of the trash is pursued, but buyers are getting more particular, and sellers find out that what they save in labour is lost in the lessened weight of cane cut. Twelve years ago numerous small mills studded the Clarence district, and of which only three are to-day in working order. All might have continued to make sugar at a profit, since the Customs duty of £5 per ton on imported sugar acts as a substantial bonus, and would have compensated for the less economical efficiency of a small mill. Like Messrs. Boothby and Leeson, all could have made sugar pay, but the growers were tempted to make contracts at higher prices, and one Company attracted all the cane to its mill. The farmers of the Upper Clarence are now growing cane more freely, and small mills get increased local support. The bulk of the cane grown is Rapphoe or Grey Fiji. The sets cost 10s. per ton, 14 cwt. suffice for an acre, and the distance apart is 5 feet. Mr. Johnson grows his own sets, and has extended the area under cane, being convinced of its profitableness. The young cane looked remarkably well, and the older fields promise a good cut. Though the plant was somewhat thin through not stooling, the foliage was of a dark, luxuriant green, indicating a yield, if the season continued favourable, of not less than 50 bushels per acre on land that is sandy. Pumpkins are sown through the maize at 15 feet intervals, and come in for pig food. A 2-acre plot of oats just harvested was at once put in with large, yellow Hogan corn, in two rows of 5 feet, and a row of pumpkins in the 10 feet interval, so as to get more ground and air, since it is not likely to be a heavy crop after oats. The variety of corn chiefly sown on this farm is Hallam's Flint, named after a farmer who fortunately had in his high ground 80 bushels of seed corn, which the flooded-out farmers of 1890 were glad to get at £1 per bag. The first crop was so good that Mr. Johnson has retained the seed.

Potatoes are an extremely profitable double crop of from 8 to 10 tons in the aggregate. The "Circular Heads," nearly ripe, were planted with winter seed grown on the farm, the product of some imported from Sydney during 1892. They showed plenty of haulm, and looked favourable, the misses being few, and tubers well shaped. "Early Vermont" were also clean and luxuriant. "Early Rose" is considered on the Clarence to be liable to blight, and is therefore discarded.

With a limited number of live stock kept in the open, there is scarcely any farm-yard manure to be made, but Mr. Johnson finds megas, to be had for the carting from the neighbouring sugar-mill, a useful application. During a recent flood a small island of it was stranded on the farm, and some applied to orange trees hitherto spare of bearing resulted in a golden yield. Cornstalks are ploughed in, for these sandy alluvials need decomposing organic matter.

The fodder crops looked well; oats yellow to nearly over ripeness for hay were judged to go 40 bushels per acre if cut for grain. An acre of lucerne was 22 inches high, ready for cutting, and sorghum, in a half-acre plot handy to the homestead, sown for summer feed, was coming up. The oaten hay is stacked in the farm-yard. No grasses are laid down; a natural growth of couch and water couch forming the pasture land, which is generally that part of a Clarence River farm too wet for cultivation. A few peas are grown for pig food.

The live stock number 6 horses, 10 cattle, 26 swine, and 140 head of poultry. There are 4 heavy draught horses of Clydesdale type, one mare

suckling a big three month foal by a Suffolk sire. Large-framed active horses are invaluable on a farm where labour is limited, and improved implements are relied on to get through a lot of work.

Mr. Johnson takes pride in a thoroughbred mare, with foal at foot, whose sire is Aberfoyle, one of the late Hon. James White's stud. The saddle horse is a well-bred thick-set animal that would take the fancy of anyone. The cattle number 10, and were of an ordinary mixed strain, 3 being milkers for home use, also 3 dry, 3 youngsters, and 1 steer. The calves are reared, and a big steer needed but a little extra feed to finish him for the butcher. The cattle are principally kept to feed down the pasture, but the profit is small, whereas the keeping of pigs is much more remunerative. The pigs number 2 boars, 4 breeding sows, 20 stores; in all, 26. Mr. Johnson prefers Poland-China, and his older boar is typical of the breed, being overhung with flesh. The breeding sows are not pure. Young pigs are sold locally or sent to Sydney. Some bacon is made at home. Clean-fed pigs make good bacon, and the surplus sells at 7d. and 8d. per lb., seven pigs having this year been cured. Treacle was in use for pig food, being purchased at 8s. 6d. per hogshead of 54 gallons, or about 25s. per ton, a price ridiculously low for so good a relish and feeding stuff.

The poultry comprise 100 head of various sorts, also 40 ducks, Muscovy being preferred, since they do not seek the creek, and so escape the danger of being eaten by eels. Eggs, table birds, and surplus butter are bartered for goods with itinerant dealers.

The garden and orchard are for home use. Book-keeping is represented by a record of purchases and sales. The labour of the farm is that of Mr. Johnson, with hired assistance at busy times.

The subsidiary aids may be ennumerated as co-operative family labour; sales of seed potatoes, dairy produce, bacon, eggs, and poultry; also light repairs.

The points of interest are excellent tillage, improved implements, the cultivation of tile-drained land, and a tenant farmer.

The general management, with a view to profit, is based on the growth of maize, cane, and potatoes, for which there are good markets. Mr. Johnson works the farm alone, hiring labour when necessary, and he is able to keep up a superior cultivation and thorough cleanliness by means of good implements and strong horses, well fed. The livestock are moderate in number. It may pay to rear a foal or two, but to breed cattle merely to eat down pasture is not very profitable at present prices. Farm-yard dung is scarce, and light soils doubly cropped need fertilisers. Megas may be got from the mill, and manure from the Ramornie Meat Works, but the need of some added fertiliser is evidently not fully recognised on the Clarence, reliance having hitherto been placed on silt deposed during floods, which gives an entirely new surface soil. Mr. Johnson is the tenant of a capital farm of 53 acres, let at £80 per annum, *e.g.*, 30s. per acre, on a lease of five years. Short leases discourage tenant farming, but Mr. Johnson has a good landlord. The turnover for the year cannot be easily got at, because of the floods, but from the data furnished it may be put down at the rate of £320 per annum.

David Doust, Bayham Farm, Clarence River, adjoining Brushgrove.

North Coast District.—Place, No. 7; points, 78·63 per cent.; arable, 51½ acres; pasture, 10 acres; homestead, ½ acre; forest, 118 acres; total, 180 acres.

(4 December, 1893.)

Mr. Doust's residence is pleasantly situated on a ridge above flood level, and commanding an extended view of the Clarence River. Grafton lies in

a direct line about 13 miles to the westward. The road on the river bank is, however, much longer, and small steamers stop to take up passengers by signal. To the south-east are prominent mountain headlands bordering the ocean, about 13 miles distant as the crow flies. Altogether the site is very charming, and from it an idea can be gained of the narrowness of the fringe of alluvial that borders the Upper Clarence, now one continuous field of waving corn. Let there but come a disastrous flood such as has been common to the last five years, a sea of water would prevail, leaving, on draining off, a mass of putrid vegetation and slushy mud. The pioneer settlers found a broad river hemmed in by high banks of most luxurious brush, sprinkled with giant timber quickly merging into a narrow forest of the heaviest gums, bloodwood, cedar, and mahogany fringing a marsh. In 1862 selection of these lands was rapidly made from Grafton downwards. Slab huts were put up on the high banks within a few yards of the main river, and the very laborious task of clearing the land was slowly proceeded with. Corn was the one product, and vessels lay alongside the homesteads loading produce for market. Mr. Doust was late in making his selection, and in 1866 could only get what others would not look at, by reason of the area being chiefly occupied by a lagoon. Out of the 180 acres taken up a great proportion was marsh and poor ridge land, covered with a forest of spotted gum, as it now is to-day. Thirty years ago the floods do not appear to have been so bad as of late; but fear of them led to a speedy removal of Mr. Doust's house on the river bank to a site on the main ridge. Prior to doing so it was necessary to make a wide corduroy road, 300 yards long—a work of great difficulty—across the marsh, and heavy trunks were therefore drawn from the forest. As time grew on the land was cleared, and to-day not a root can be met with. The problem of the marsh remained to be attacked until about eight years ago, when a contract was let to dig a ditch 12 feet wide by 4 feet deep and 46 chains in length. The mud was used to fill up hollows, and some 20 chains of narrower drains were cut, leading into the main one. The river bank was pierced by 6 chains of triangular-shaped box drains, having two outlets, forming a Y shape, and protected at their mouths by flood doors or flaps on hinges. Not only is Mr. Doust's portion of the marsh completely drained, but he has benefited his neighbour to an equal extent, so that, could the betterment principle have been applied, some of the £400 cost might have been shared. Several additional selections were made since the first, and the whole was worked as one farm. Now a great part of the origina. farm has been let off to Mr. Doust's sons, and the present occupation will probably soon be transferred to the eldest son. It may here be mentioned that the present competition, deferred from 1892 by reason of the floods, had been overlooked by Mr. Doust, who went in April last on a trip to England, and only returned in November. During the interval the farm had been worked short-handed by a son, so that the characteristic management was not continued. The farm, however, presents many interesting features, that of drainage, placing the homestead above flood level, and the subdivision of the original farm into many, leased by the sons.

The soil is a very deep, sandy alluvial, sloping from the main bank down to the drained lagoon. Water is conserved in a dam for the stock on the back forest ridge, and in underground tanks for household purposes. The boundary fence is partly four-wire, and substantial two-rail. The cultivation area has no divisional fences, not even with the son's land adjoining. The main road is the corduroy one already noticed. There are four gates, and, although white ants do damage, the fences were in good repair.

The homestead is on the ridge above flood-level, and was nearly wholly built by Mr. Doust and his sons, the former being a self-taught carpenter of no small skill. The residence is of weatherboard, containing six rooms, with kitchen and offices in the original slab cottage at the rear. Near by is the dairy, consisting of an inner structure beneath another roof supported independently on stout posts, whereby an even temperature is maintained, and the butter is kept in good order. The coach-house and poultry-house are also near. The farmsteading consists of a well-built barn of slabs and weatherboard, roofed with shingles, containing the corn-sheller driven by horse-gear. Adjoining are the harness shed, blacksmith's shop, two-stall stable, and stock-yards. Just prior to the floods of the last few years, Mr. Doust was opening up a trade with Sydney in lucerne hay, and specially constructed a large hay-shed 60 ft. x 40 ft., roofed with iron; it is now used for the storage of fodder crops. There are also a partly-roofed mid-day manger and piggeries with paling roofs and slab floors.

The implements comprise one two-furrow plough by Ritchie, which does excellent work, two one-furrow ploughs, by local makers, a set of iron harness (M'Diarmid of Grafton), wooden harrows, two A-shaped scarifiers, and a long-tined one to eradicate couch, all being home made; also, two wooden rollers; an American disc-harrow is much liked, and the "Planet" horse-hoe is in use. One of the first cane-choppers on the river was purchased by Mr. Doust, a machine made by Page, of Grafton, having 20-inch steel discs like coulters, but it does not such good work as one with knives. A horse-rake and a mower, both by Sim, of Morpeth; the latter had been in use for many years, and from its substantial make showed no sign of wear. The "Farmer's Friend" corn-planter; the "Veteran" sheller, for power, and a hand-sheller by Sim; power chaff-cutter, by Bentall; horse-gear, by Hunt; Avery's platform scales, blacksmith's and carpenter's shop, two carts, and two slides complete the list. The buggy was sold prior to the trip to England, and has not as yet been replaced.

The farm is cultivated as follows:—Maize, 45 acres; potatoes, 3 acres; pumpkins, 2 acres; melons, ½ acre; lucerne, 1 acre; total arable, 51½ acres; pasture, 10 acres; homestead, ½ acre; and forest, 118 acres; in all 180 acres. Maize is grown continuously, with smaller areas—3 to 5 acres—each year broken up for potatoes according as there is a demand. The earliest corn is an American sort, "Leaming's," got out by the Clarence P. and A. Society, and now extensively grown. Its stalk is short, free from blight, and ripens early. Small, medium, and large "Red Core" are also sown, ripening in the order stated. The cultivation is as follows:—All rubbish and stalks are gathered by the harrow and ploughed in. The land is well worked, with probably a second ploughing. Sowing takes place early in August and up to December, the corn ripening from January to May. The cobs are husked and cleaned in the barn. The corn is carted to the wharf and loaded on board the Sydney steamer, the freight being 1s. per bag of 4 bushels. The older lands yield 50 bushels, and those lately cleared up to 70 bushels per acre.

Two crops of potatoes are got yearly, the seed for the summer crop coming from Sydney, and then its sets do for the winter crop. "Circular Heads" are alone used. Mr. Doust brought out from England some choice potatoes gathered from various farms in Kent, where he saw large crops growing. They comprised "Early White," "Hampshire Kidney," "Tenner's Wonder," "Webber's Early White," "Beauty," and "Sutton's Abundance." Although planted late, it is to be hoped that they will become acclimatised and prove acceptable additions to the few varieties that have been run upon in this Colony.

Three kinds of watermelons are sown—"Cuban Queen," "Scaly Bark," and "Orange." The market is Sydney, but unless sent early the venture is scarcely profitable, what with freight 1s. 6d. per dozen, and the market fully supplied from districts nearer the metropolis. If sown in August, they become ripe in December, and realise 12s. per dozen, but if sent forward later only 3s. to 6s. is obtained. Cucumbers sent down in October fetch from 3s. to 6s. per dozen, but they have no such sale in December. In order to be early, sowing must take place in July in a seed bed, and transplanting in August, so as to be ready the first week in October. Pumpkins are sown throughout the corn for home use, and grama in odd corners, being good food for pigs. In 1889, 10 acres of lucerne were laid down for the Sydney market, but the floods of 1890 destroyed nearly all, and the large shed put up specially at a cost of £120 was rendered of but little service save to store oaten hay for home use. The 10 acres of pasture between the homestead and cultivated area are used for the horses, but land so rich would pay better if ploughed, Cane is now the second crop on the Clarence, and with a view to planting out several acres next season, some Rapphoe was being grown for sets.

No manure is purchased, and next to none made, for the live stock are seldom yarded. The land will profit by manure. The older lands show a lessened crop, whilst nothing can be done with the forest lands on this farm without a fertiliser. The time will surely come when those who own lands liable to flood will be glad to have some ridge country whereon to build and keep the live stock. As it now is, to own a dairy herd on the flats is to run the risk of a flood coming and the milkers being injured by enforced neglect, whereas, if fodder grown on the flats be fed to cattle on the ridges, dairying could be more generally pursued and the poor lands enriched.

Fodder is conserved for home use, such as oaten hay, and no grasses have been laid down, couch and water-couch forming the staple of the pasture.

The live stock number 12 horses, 7 cattle, 20 swine, and 30 head of poultry. The 8 heavy draught horses are good, useful animals; there are also 2 saddle horses, and 2 foals, one being an extremely pretty one about three months old. Two milkers were kept for home use, Mrs. Doust making excellent butter for a hot climate by the hand system; the surplus is sold to hawkers. The remaining 5 cattle of various ages are kept to eat down pasture. Mr. Doust is persuaded of the unprofitableness of raising cattle at present prices, but his farm is at present in a transition state. The pigs number 20, and comprise 4 breeding sows, 2 fat, 6 fatting, and 8 store. A large number of pigs are kept beyond the 4 breeding sows, and considering how the district is liable to flood, it is an open question whether a portion of the corn crop might not be fed to pigs, ensilage being availed of, which would neither float away nor be injured by immersion. Crops of corn destroyed season after season will ruin the strongest farmer, but silage is made before the flood season sets in. There is always a ready sale for bacon-pigs, and if a certain supply were available there would be encouragement for a local bacon factory, possibly on co-operative lines. Two pigs fed on lucerne and inferior corn were about 140 lb. each and ready for killing, and 6 others about three months old were making rapid progress. In past years many pigs per annum were cured, there being a good local demand for bacon from this farm. Hitherto poultry had been kept in large numbers, but "the disease," a species evidently of chicken cholera, in September last swept off the greater part. This plague is common in spring, and, doubtless, is communicated through food lying about and becoming contaminated.

There is a small kitchen garden and sixteen hives of bees, which with modern appliances would become a subsidiary aid of some value. During

summer much honey is usually made quickly, but this season it has not been so. No full books of accounts are kept; merely records of sales and purchases with the usual data with regard to the general work of the farm. The hay-shed occupies the site of the old orchard, of which only a few decayed trees remain.

The subsidiary aids may be enumerated as co-operative family labour, sales of bacon, butter, eggs, honey, poultry, and early vegetables, such as melons, cucumbers, also some lucerne hay. Building, implements, and repairs done at home.

The points of interest are drainage of a marsh, erection by own labour of the homestead, early vegetable and lucerne growing.

The general management with a view to profit is based on one crop, maize—sugar is about to be made a second. Very heavy work had been accomplished, at first in clearing and draining the land. Profits in the past have been good, and the tillage has been thoroughly done, maize being continuously grown, and the land replenished by silt after floods. The area selected, discarded by the early settlers, has been skilfully brought under cultivation, and the greater part is now let off to members of the family.

E. J. Dening, Roseville, Euroka, near Kempsey, Macleay River.

North Coast District.—Place, No. 3; points, 84·10 per cent.; arable, 19 acres; pasture, ½ acre; homestead and pig paddock, 2 acres; orchard, ½ acre; total, 22 acres.
(9 December, 1893.)

Mr. Dening has been for twenty-six years a resident of the Macleay, but is a native of the Colony, having been born in the Parramatta River district, and pursued the avocation of a market gardener at Five Dock, near Sydney, prior to his settlement on the Macleay. In 1869 he purchased Roseville, at a cost of about £12 per acre, in all £250 for 22 acres of really good land. Much labour was needed to bring the property into its present excellent state. The original brush had been exceedingly dense, with enormous timber, whilst the seller had only felled the trees, erected a small hut, and left a forest of big stumps. Now not a root remains, and the farm presents an object lesson both in neatness and in a use being found for every foot of ground. Mr. Dening lived on the farm till 1875, when he revisited Sydney, letting the land for five years. These 22 acres, cultivated with the skill of a market gardener, have chiefly assisted—a second farm, 2 miles off, having been rented from 1880 to 1886—to build up a substantial homestead in 1887, and keep a family of ten in a superior manner. The distance from Kempsey is 3 miles, but the broad Macleay intervenes, and has to be crossed by the punt. Hawkers call frequently, and pay cash for the products of the farm, Mr. Dening preferring to work through them than distribute himself.

The residence stands above flood-level on a gravel ridge overlooking the farm. The Macleay, when in a great flood, rises in places over 60 feet, and a wide extent of country is overflowed, including the farm in question. Euroka Creek is a narrow stream, between deep banks of silt, perhaps over 30 feet, intersecting the farm, and is crossed by a good bridge on a main road, which bounds the property. The only pasture on the farm is half-an-acre, comprising the sloping banks of the creek, and serving as a run for the live stock. These banks show a great depth of fine silt, the basis of a splendid soil, in which the deep roots of lucerne revel. The present crop of maize is most promising, and only needs some rain to bring it to perfection. The expectation of a flood clouds the horizon of an alluvial farmer, since he may see the fairest prospects ruined within two days, but these farms, however, yield most profit when drought prevails elsewhere, and, as a class, the

farmers of the Macleay have done excellently well. There is no reason why sugar-cane may not succeed. Many years ago its cultivation was taken up with enthusiasm, but, unhappily, a most unusual frost occurred during the first season, destroying the crop, and inducing the mill proprietors to remove at once the machinery to the Clarence.

The soil is so porous as not to need drainage, but Mr. Dening, in conjunction with a neighbour, has, by means of a 12-inch square wooden box-drain, with its outlet inserted 20 feet deep in the bank of the creek, drawn off the soakage from several acres of lagoon, and the whole could have been drained dry, but that the neighbour preferred to have some water. In two years the entire cost was recouped by the luxuriant crops of maize taken off hitherto useless soil. Rain-water is conserved for household use in a cemented tank, placed cleverly beneath a verandah of the residence, and a good force-pump, with hose attached, commands the flower garden, in which Mr. Dening shows much skill as a florist. The live stock have access to the creek by a narrow lane, and, as a large number of pigs are kept, they thereby water themselves.

The fences are two and three rail, and suffered much damage in the July flood through solid banks of small *débris* being entangled, and as the current was strong no fence could withstand. Those with wire fortunately remained intact as they fell, otherwise posts and rails were widely dispersed. The attention now paid by Mr. Dening to pig feeding arose from a suggestion made by Mr. Despeissis, when recently acting as a judge of farms, and the enterprise has been thoroughly gone into, provision being made for a large number, and paddocks over 2 acres in extent rendered pig-proof. The flood of last July swept away all the planted supplies of food for pig keeping for this season, and in consequence there are now the 5 breeding sows and only a few stores. One feature about the headlands of the maize crop deserves attention, in that stock press in on and damage the rails to get at the green plants, so that it is customary to keep the crop back 6 feet, leaving long strips of ground frequently given up to weeds. Land is, however, too valuable to be so wasted, wherefore Mr. Dening had plantations of arrowroot, but of which the flood has left only one plant. Stock, fortunately, will not touch the leaves, which shield the maize, whilst pigs do well on the tubes and stems. This season some oats are growing on these strips of land for hay or soiling, the live stock being fed with green food, cut by hand and entailing some labour, but yielding much manure.

This little farm, of 22 acres, possesses a superior residence of eleven rooms, in the erection of which Mr. Dening largely assisted, and the cost may be taken as £600. The design was one of a series published several years ago in the *Sydney Mail,* and when seen as a reality possesses great merit. The house is pleasantly situated in a large flower garden with several rows of good-sized fruit-trees on either side. The farm buildings were entirely put up by Mr. Dening during the two years immediately following the building of the house, and deserve notice for their neatness. The roofs throughout are of iron. The barn measures 40 ft. x 18 ft., the hay barn 30 ft. x 13 ft. A range of buildings under one roof comprises the buggy-house, workshop, cart-shed, 2 milking bails, 2 stalls for plough horses, and 2 for buggy horses. The milking yard is partially paved with slabs—an excellent idea, and over it generally the manure is made by trampling cores, waste green food, and litter, the pigs having free access to rout all about. The surface exposed to rain is too extensive for economy, and it would be difficult to keep fermentation going in dry weather. There are separate piggeries, providing for 200 head, with many pig-proof yards. The list of buildings is

completed by a fuel house, where cores are kept for household use. The area covered by the farm buildings is ½ acre, and another ½ acre for the house and garden.

The collection of implements is of some interest in that American ploughs have a reputation on the Macleay, high approval being given to the chilled digging mouldboard throwing up a shattered tilth with its wide deep furrow. The Moline Co.'s "Scotch Clipper" is Mr. Dening's favourite plough of this description, and he points out that its arched beam permits the use of a disc coulter 20 inches in diameter, which rubbish will not clog. For planting corn, Howard's single furrow, with the ordinary mouldboard is used. A one-furrow American digging plough with a wood beam is used for hilling maize. Mr. Dening makes the woodwork of his implements, such as harrows, A-shaped horse hoes and scarifiers, duck-foot expanding cultivator, rollers, and the corn coverer. This latter is somewhat of a novelty, and consists merely of a 10-inch plank, 4 feet long, with a pair of short handles, plough-like, and two pairs of iron tines 10 inches long, and set widening outwards. By its means the covering in of the seed, which is dropped by hand, is effectively done. An American 7-feet disc harrow makes good work. The barn implements comprise a corn-sheller, by Sim; a corn-cracker, by the Ames Co.; a chaff-cutter, by Hudson Brothers; and a wire sieve for screening maize; also, a cart, buggy, sack truck, slide, carpenter's tools, and appliances for a small hand dairy.

On a purely alluvial soil of so great depth a rotation is not deemed necessary, for floods replenish with silt, though they at times deposit barren sand, or even take away the useful surface soil. Maize is the chief crop, and occupies 19 acres. Around the headlands strips of oats are grown, and ½ acre just cleared of oats for hay is about to be put in with sorghum and imphie, to cut for green feed in June. Pumpkins are planted throughout the maize, which, after being quartered, are sliced in the chaff-cutter, and used for all stock. Oats sown in May are cut for green feed late in November. Imphie and sorghum sown after oats in December are cut in June. "Rio" pumpkins also put in after oats in December are used for feed in the winter months, lasting from May to August. Tares and oats are sown in February for early spring feed about September. Barley sown in April is available for late spring feed about October, or a portion is made into hay in October. Lucerne is cut every four weeks through early summer, and every six weeks during the last of the summer, so that it is available particularly from November to March, and only yields no feed during the three months of midwinter—June to August.

To put the above into tabular form a clearer view will be got of the scheme of feeding:—Winter, three months, June to August: Imphie, sorghum, pumpkins, oaten hay. Spring, three months, September to November: Early tares, late barley, oats. Summer, three months, December to February: Lucerne, inferior maize, as green food. Autumn, three months, March to May: Live stock on the stubbles.

The breadths under potatoes, melons, pumpkins, herbs, sugar-beet, mangold, and arrowroot are small, but serve to supply hawkers, and the surplus is used for the stock. The cultivation of the maize is as follows:—The seed-bed is carefully prepared. This year the eradication of nut-grass, left by the flood, necessitated extra labour to the extent of £7 12s., for to have left it untouched would have made it a permanent weed. A second ploughing to bury weeds is preferred to scarifying, the digging breast being used instead of the ordinary mould-board. The latter is employed to make the furrows 45 inches apart, in which the seed is dropped. Weeds are

rigorously kept under, but when tasselling occurs they must needs be left untouched in the corn, and have three months before them undisturbed, which gives a growth of 4 feet high in this rich soil. Hilling is done by the wide central furrow of a Moline plough. The cobs are husked in the barn, the cores are used for fuel, and the husks for feed. The only variety of corn sown is "Golden Beauty," obtained from seed introduced two years ago from Queensland, and highly thought of by reason of its good yield, low stalks, heavy corn, and the good price realised. The growing crop was all that could be desired; tall, few misses, clean, with caterpillars and blight scarce, promising cobs, and luxuriant foliage. Mr. Dening regularly goes through the growing maize to cut out as green feed all inferior and diseased plants.

The potato crop was a promising one of "Peach Blossom," from seed obtained three years ago; some supposed "Brownell's Beauty" were also growing from seed got this year from Sydney, but they were probably "Circular Heads" misnamed. Hawkers buy what they want, and the surplus is used for pig food. The flood destroyed nearly all the lucerne, but that remaining was laid down three years ago, and now yields a beautiful cut. At first a few spots of dodder or "ring-worm" were observed, but by cutting them out and sprinkling the ground with boiling water the parasite was destroyed, and no harm done the lucerne by the remedy. The July flood destroyed all the small areas of Swede turnips, sugar-beet, mangolds, and arrowroot that were relied on for pig food.

The making of manure has already been noticed. Stalks are ploughed in. Fertilisers are not purchased. There are in the neighbourhood deposits of marble, beds of oyster shells, and caves of bats' dung, but these sources of fertilisers do not appear to have been exploited. The limestone can be easily put on board vessels, and is a deposit that might be cheaply availed of for agricultural purposes generally.

The conservation of fodder is represented by oaten hay, stored in the hay barn, but green fodder is the interesting feature of this farm, Mr. Dening having proved it to be a profitable source of revenue. He is, moreover, impressed with the need of making a provision of food against floods, lest the live-stock be again sold off because of starvation. Ensilage lends itself to this purpose, and may probably be employed.

The live-stock carried by this farm of 22 acres comprise 4 horses, 12 cattle, 62 swine, and 130 head of poultry. The two plough horses are aged, but do their work, and the two light horses serve for buggy and general purposes. None are bred. Six cows are in milk, no bull is kept, and calves have been reared in the past until there are now too many cattle. The surplus hand-made butter is sold locally at good prices, fetching from 8d. to 1s. per lb. The swine number 1 boar, 5 breeding sows, 10 fattening, 3 months old, 40 stores, and a litter of 6; in all, 62. Two hundred head of swine would have been kept had not the flood destroyed the provision of food, but since July 110 have been sold, and to economise food the sows have missed a litter. A boar and sow of pure Berkshire type are kept, the other four sows being of a mixed type. One is a noted mother, having reared thirty-three pigs in three litters within twelve months. Ten three-months-old pigs were fattening, and these, besides forty stores, together with a week-old litter of six. It was intended at first to make bacon largely, but it was speedily found to be more profitable to sell live pigs in the Sydney market. Twenty-three pigs have been cured this year, a portion for home use, and local storekeepers buy bacon at 5½d. per lb., but the barter system does not tend to develop an industry. The poultry were of various breeds, and dealers take away both

eggs and table birds. A plot in a field near the house is set apart for vegetables for sale if asked for. "Ice cream" melons sell freely to hawkers at 8s. per dozen, and had it not been for the flood half an acre would have been cropped. A recent hailstorm injured the orchard; the principal trees have been grown from cuttings, taken because Mr. Dening fancied the originals. Many have made capital growth, with clean bark and few pests, but the apples suffer from a borer beetle.

The bookkeeping showed all the purchases and sales, but no balance-sheet could be made out. The labour is that of two adults, Mr. Dening and his son, assisted by the co-operation of the family. The floods this year necessitated extra labour in putting the fences right and digging out nut-grass. The turn over in 1892 was £184 from 22 acres.

The subsidiary aids are co-operative family labour, home building and repairs, implements made, bacon-curing, sales of vegetables, fruit, melons, butter, eggs, poultry.

The points of interest may be enumerated as a small area of rich land wholly under the plough, a large number of live-stock fed by soiling, pig-breeding on a large scale, local sales of produce to hawkers for cash or barter; land drained, good implements used, headlands cropped, weeds kept under, and a superior homestead built.

The management with a view to profit was good, every little help being used to swell the turn-over. The cropping was more that of a market garden, and everything was done well. This farm gives an indication of how much may be produced from a small area of really good soil, and the comfortable residence affords a proof of the profits that have been realised. Particular mention must be made of the extended breeding of pigs, as showing the true lines for an alluvial farmer to go upon, and the loss of food by the flood indicates how valuable ensilage would prove itself to be.

Bernard Muscio, Purfleet, Taree, Manning River.

North Coast District.—Place, No. 2; points, 86·42 per cent.; arable, 31½ acres; pasture, 13 acres; homestead, ½ acre; orchard, 5 acres; total, 50 acres.
(14 December, 1893.)

In 1857 Mr. Muscio left his native canton of Ticino, in Italian Switzerland, to join his brother in New South Wales. He was then 16 years of age, and had worked on his father's small Alpine farm. The Manning River was his destination, and he stayed three years with his brother. After six months spent in gold-digging, he and his brother rented 16 acres of alluvial land at Taree. The owner was at a feud with his neighbours, and they visited their uncongeniality upon the hard-working tenants by refusing them access by road to the wharf, so that in order to ship their corn the brothers had to perilously carry the bags on their backs across a narrow log spanning the creek. Under such circumstances they abandoned the lease in 1861, and bought good land on the Hastings at £4 10s. per acre. The Manning, however, retained its attraction, and in 1879 the brothers bought adjoining farms at Taree, paying £24 10s. per acre, *e.g.*, the 50 acres entered for competition cost £1,225. The land was first rate, but its condition deplorable, giant stumps abounded, fences were decayed, the slab hut and barn scarcely better, and the land was ruined by weeds. The labour of Mr. Muscio, single-handed, has changed all this, and both residence and homestead have been built by him with the assistance of a few days' hired labour to fix the roof. In 1882-3 it was difficult to get good building timber on the Manning, and much additional labour was expended in trimming and straightening boards, so that the cost was about £450.

Maize has been throughout the main crop of the farm, whose area of 50 acres is nearly too great a task for one man to cultivate. The farm is got at by boat crossing the broad tidal waters of the Manning. Taree lies on the opposite bank, 800 yards distant, and droughers load corn at the barn, where the banks are 25 feet high. Floods are, however, seldom bank high, and not a great one has been experienced since the erection of the house, which stands next the stream. The first maize paddock dips to some partially-drained grass land, whereon the stock run. Then there is a rise, and the second maize paddock slopes gently down to a creek crossed by a 50-ft. bridge, erected with neighbours at a cost of £20, and on the other side of which the farm is continued. The soil throughout is a deep, porous, sandy alluvial silt, capable of continuously bearing maize, but its fertility lies in its depth, for when maize followed potatoes there was only half a crop, showing exhaustion of the upper layers. The climate is moist, like that of the northern rivers generally, so as to render fungoid pests a source of trouble, and for this reason vine-culture languishes.

The 6 acres of wet grass-land was once a lagoon that has been drained by four neighbours uniting to make a deep cut 8 chains in length, and Mr. Muscio has also run a cross drain 4 chains long. His experience of co-operation in agriculture is that he may clean the deep ditch as often as he likes with no one to help, and the labour of throwing dirt up 10 feet is too much for one man. Had timber been cheap, it would far better have been a triangular underground drain, pipes being out of the question, but all timber has long ago been cleared from the alluvial flats of the Manning. Rain-water is conserved in iron tanks for household use, and in the grass-paddocks there are shallow sinkings, that are slabbed so as to enable stock to drink.

The fences are substantial two and three rail, in good order, and free from weeds. There are several gates, and those on a Government road dividing the farms have been designed and put up by Mr. Muscio; one gate in particular has a double swing for shutting one of two grazing-paddocks off to live-stock.

The residence of weatherboard contains six rooms, and is of a superior character. There is a 3-room kitchen and offices at the back, and in front and on one side are flower gardens which add to the annual income by the sale of cut flowers. The dairy is a separate weatherboard building, 15 ft. x 8 ft., and also serves as a store for fruits preserved in syrup and glass, in the preparation of which Mrs. Muscio excels. A separate building is used as an incubator house, as well as a bacon-smoking chamber, when boards and fittings are taken out. The poultry house, 20 ft. x 12 ft., is of a superior character, and kept perfectly clean; the material is weatherboard, with shingle roof, wire front, and an inner nesting room. There are several runs for the poultry, and one that is grassed is kept for special breeds. Leghorns are preferred now for general purposes and to the exclusion of all others, since eggs are largely sold. A wash-house in the new orchard affords a double convenience for household purposes as well as for compounding spray mixtures, &c. The apiary is a neat shingled roof, 20 ft. x 8 ft., with an inner framed stand strong enough to bear a great weight, and with four legs resting in hollowed log water-troughs, so as to baffle the black ants, which kill the bees. Room is provided for fifty hives. The corn barn, 50 ft. x 22 ft., is particularly well built, the roof being of iron, and the stout main posts are sunk 5 feet in the ground as a precaution in time of flood. The hay barn, with a picturesque shingle roof, and upper story for oaten hay, has two divisions on the main floor, in one of which barley in the straw is kept, the grain serving for poultry food. The dimensions are 32 ft. x 22 ft., and a

wing extends on one side forming a five-stall stable, boarded against the south winds, but open to the north. On the other side is the milking-yard, with a length of roof and shelter against the south. Beyond are the piggeries, with similar roof and shelter, providing four single and one double sleeping styes on wood floors raised 12 inches, and opening to slab-paved yards. The troughs are hollowed logs with neat shoots of wood to guide the wash from buckets on the outside. The wharf is within a few yards of the homestead, and has a flight of steps up the bank, and a small pen for shipping swine. When the property was bought, some hundreds of tons of sandstone ballast lay at the old wharf unloaded from sailing vessels calling for maize, and the greater part has been utilised by Mr. Muscio in protecting the bank against the scour of small steamers.

The implements comprise three one-furrow ploughs of local make. The heavy one, drawn by three horses, and to plough hard ground, is by Anderson, of Cundletown, and has attached a 20-inch disc coulter to cut maize stalks. Allen, of the same place, made the plough specially used for covering in weeds, and Manners, of Taree, the little hilling plough. Mr. Muscio has discarded a disc harrow, and finding he cannot control the little Yankee swing plough aspires to possess a genuine English made two-furrow gang plough. The harrows are home-made, and comprise a heavy triangular, which, when weighted and drawn by three horses, alone can be depended on to break down stubborn clods. A long tined harrow is used to root out weeds and nut-grass. The "Planet" horse hoe is deemed too light, jumping right out, and skipping the weeds through the tines not overlapping. Mr. Muscio regards it as time wasted in having to hand-hoe weeds left by an inefficient implement. A spiked roller has been discarded as a clod-crusher. A "Farmer's Friend" corn-planter is used. In the barn there is a "Veteran" sheller, hand-sheller by Manners, wheelbarrow and corn-cracker by Ames Company; there are also a horse-gear, wood roller, dray, slide, buggy, the appliances for a small hand-dairy, and 150 feet of hose for the garden.

The farm is divided as follows:—Under cultivation, 31½ acres; pasture, 13 acres; orchard, 5 acres; homestead, ½ acre; total 50 acres. The cropping this season is maize; 30 acres, with pumpkins interspersed, also 1½ acres additional in pumpkins, put in after oats and barley just harvested. In the 8 acres of new orchard, potatoes, lucerne, and melons are being grown. The cultivation of maize is to thoroughly prepare the ground, open a furrow, and follow with the planter, and weeds are kept down by frequent horse and hand hoeings. The variety sown is "Golden Drop," got two years ago from a neighbour, and has always proved a good corn. It is sown at the end of October, for late maize is generally blighted, yet weevils attack too early corn in the field. The crop throughout was very clean, of a good height, the leaves not over luxuriantly green, and in the forward plots the cobs swelling promised a yield of about 50 bushels to the acre. Very little space was left between the crop and the fences, and corn is sprinkled thickly on the edges when sowing is in progress so as to feed bandicoots and save that drilled. An acre next the homestead has been kept for green barley and imphie, the cut stuff being thrown over the fence at a place where a second low rail prevents trampling.

Two years ago Mr. Muscio grew fourteen varieties of potato, and none succeeded like "Snowflake." The one acre in the new orchard was planted with seed that won a prize at a local show, and the yield promises to be fair and the tubers large and clean skinned, but few seasons have suffered so much from high winds as the present. The Manning soils, without manure, will not allow of double cropping.

Manure receives careful attention on this farm, in that it is kept under cover, and all that can be gathered from stables, milking-yards, and piggeries is there heaped up. Owing, however, to want of trampling and moisture, the heap was somewhat fiery. The shelter forms an excellent feature, but a covered sunk yard should be provided, to which pigs have access, so that their rooting, trampling, and urine would make the manure. The soakage from exposed heaps and yards carries off all the soluble plant nutriment, whilst proper fermentation cannot be secured without attention.

Fodder is provided by the growth of oats for hay and barley, reaped by hand, the grain serving for poultry food. Both were stored in the hay barn. Some grass-land has been laid down, 6 acres being sown two years ago with rye-grass, prairie, and white clover. Since then the grazing has been continuous, and the rye shows a tendency to die out, and, possibly, the land would be better under cultivation.

A portion of the lagoon paddock, about 2 acres, which is wet after floods, but gets dry in summer, was planted a few years ago with osiers, but the variety was said to have been wrong, and they have been taken out. At present rushes have choked all grass, although water couch does well. They will, however, die out in time. Nut-grass, introduced by the last flood, has taken firm hold of many places in the farm, despite continuous attempts to dig it out. A final effort is to be made by letting swine root it. Its nodular roots may be found at a depth of 6 feet, and constant cutting off of the leaves by horse or hand hoe apparently does no good. It is possible that dense couch or prairie or sorghum may stifle it, but in the absence of experiments Mr. Muscio has had to hire labour to dig it out.

The live-stock comprise 4 horses, 12 cattle, 12 swine, and 292 head of poultry. The 3 plough-horses are of a good type, and the light horse is used for saddle or buggy. There are 6 milch cows (one is said to have had a Holstein mother; at all events, both she and her daughter are the two best milkers), 3 heifers, and 3 calves. Last year the stock was reduced to 12, since Mr. Muscio had not time to look after so many. They have a 40-acre paddock in the bush to run on. The swine comprise one Poland-China boar, three months old, that took a local prize when a youngster, and is a characteristic good hog. The sows of the same breed were in a purposely poor condition, so that they may the more readily root out nut-grass. The market for pigs is Sydney. Poultry are well looked after. Dealers call and collect the eggs and table birds in exchange for goods, and as Mr. Muscio's family is a large one the arrangement serves. £10 was invested in a 70-egg incubator, two years ago, with patent brooder, but a sitting hen is preferred to the "Petaluma." Poultry are allowed free access to the orchards. Powdered oyster-shells and crockery are given. Fortunately, disease is rare, and there is a hospital for the immediate isolation of sick fowls. The houses and yards are kept quite clean, lime and whitewash being freely used, and the fowl manure is reserved for the garden. The bees have proved a trouble of late, owing, it is said, to black ants entering the hives and killing them, wherefor the legs of the apiary stand in water-troughs, and boiling water thrown on the nests kills the ants. Owing to the enthusiasm induced by Mr. Gale's lectures, bees are much sought after on the Manning, and swarms are now difficult to buy.

The vegetable garden suffices for home use, and if hawkers call they are supplied; in fact, more might be done in this line. Mr. Muscio is indebted to the *Agricultural Gazette* for the desire to enlarge the orchard, his interest having been attracted by Mr. Benson's admirable papers on Fruit and Orange Culture. At present the orchard is about 5 acres, but the intention

is to plant 12 acres with trees that bear fruit of excellent quality early, so as to be first in the market. With this in view, he has obtained young selected plants to furnish scions for home-grown stocks. These latter are being grown in large numbers on the banks of the creek that divides the farm into two portions. Quince stocks for pears, peach seedlings, bitter orange and lemon seedlings; loquats for apples. Although many of the purchased orange plants have only been transplanted three months, yet some have furnished forty scions. Not only does the soil lend itself to such rapid growth, but these plants were sent from Mr. Pye's, of Parramatta, with balls of earth in boxes, whereas those that came with their roots wrapped in straw have had a struggle to live.

The following selection may guide others interested in orchards:—Oranges: "Washington Navel," "Mediterranean Sweet," "Federation," and "Frontignac." Some are grafted on lemon stocks, others on the bitter orange. The hint given that grafting is easier when the sap is rising led to many losses, through not covering immediately with a shade from the rays of the sun. The stocks were from seed sown September a year ago, and grafting was done last September. A tree costing 2s. 6d. gave forty scions, of which twenty-five grafts lived, and this economy is within reach of all. In order to shelter the orchard from strong winds that do much damage, trees are necessary; and in order to grow profitable trees, external and internal cross-rows of "White Orange" have been planted. It is hoped that the fruit will be ready early in January for the Sydney market. Other varieties of orange are being tried, such as "Holdfast," "Early Acme," and "Late Acme." No lemons will be grown, since they are deemed unprofitable.

The following pears have been selected:—"Early Christmas," with a view to an early crop, and "Beurré Giffard" will be tried; for long keeping, "Beurré de Rance," which is said to keep six months after pulling; and for export to England "Winter Nelis" is deemed indispensable. These trees are to be grafted on home-grown scions.

For apple stocks, loquats have been chosen, since they appear to defy all attacks. The following have been selected:—"Smith's Early Red," "Winter Pearmain," "Jupp's Surprise," "Frampton's Late," "Golden Russet," "Ribstone Pippin," and "Golden Pippin." For apricots, "Neverfail" is preferred, since it is a great bearer, and originated fifteen years ago in the Colony. Peaches grow luxuriantly, and on the banks there are a great number ready for grafting, "Howard's Early" being the favourite for scions. The aphis has been driven away by constant syringing with kerosene emulsion. Black ants frequently kill young trees, but boiling-water on the nests exterminates them. Persimmons take with the public, and 117 trees have been put in, 17 ft. x 17 ft., and occupy nearly an acre.

Book-keeping is merely a record of sales and purchases. The labour is that of Mr. Muscio, with hired help at times.

The subsidiary aids are co-operative family labour, carpentry and building, light repairs, sales of dairy produce, bacon, eggs, table-birds, vegetables and flowers, and making of preserved fruits. The points of interest are drainage, enterprise in building the homestead, and planting a 5-acre orchard, to be extended to 12 acres; the development of the minor industries of the farm, such as poultry, bees, and flowers; the making of manure under cover.

The management, with a view to profit, has been excellent. The planting of a large orchard is being conducted with skill and economy, and the ideal of early or late fruits of the best sorts is worthy of note. The returns for 1892 show that maize realised £203; live-stock, £64; and the smaller industries, £46; in all, £313, from a 50-acre farm worked by one man.

MIXED FARMS under 200 acres.

	Points.	Haywood Bros.	Muscio, D.	Dening, E. J.	Johnson, J. W.	M'Lachlan, H.	Gibson, E.	Doust, D.	Green, G. K.	Waters, M.	Swan, W.
System of underground drainage*	50*	45	40	40	45	...	35	50	30	...	35
Conservation of water, and its economical application...	80	60	60	60	60	60	60	60	50	50	60
Character and condition of fences, gates, &c.	40	34	38	31	28	31	28	29	28	25	28
Plan, character, and condition of farm-house, buildings, &c. ...	40	36	36	36	34	34	34	36	31	25	29
Kinds of implements, condition, &c.	60	59	53	53	60	52	47	55	47	45	37
System of cultivation, rotation, &c.	80	77	80	80	79	78	68	75	76	78	58
State of crops as to cleanness and cultivation	100	99	96	99	99	96	96	94	94	97	96
Productiveness of crops	50	50	50	50	50	50	49	50	50	50	49
Conservation of manure made on the farm	50	42	50	45	42	44	32	40	38	31	10
System of manuring*	50*	...	...	...	...	...	...	...	...	...	...
Means used for conserving fodder	60	41	33	33	38	33	36	33	35	38	25
System of laying down grasses	20	20	15	10	5	10	20	5	10	10	20
Class and condition of stock	50	49	48	46	45	45	49	39	44	48	40
Vegetable and fruit garden	25	24	25	25	8	16	14	9	23	15	4
Mode of book-keeping	20	10	7	7	7	7	8	7	7	7	8
Number and condition of subsidiary aids to farm	80	65	55	52	50	48	50	45	53	52	30
Any new point of interest and commercial value, such as new crops, ensilage, &c.	20	14	15	13	10	10	9	12	13	12	7
General management, with a view to profit	125	114	120	119	115	109	115	108	110	105	94
Total points	1,000	839	821	799	770	723	750	747	739	688	630
Highest number of points*	...	950*	950*	950*	950*	900*	950*	950*	950*	900*	950*
Percentage of points...	...	88·31	86·42	84·10	81·05	80·33	78·94	78·63	77·78	76·44	66·31

* NOTE.—The prizes will be awarded to the entries gaining the highest percentage of excellence—not necessarily the greatest total of points. Thus, in the event of any of the improvements indicated with an asterisk (*) being deemed by the judge unnecessary on any competing farm, the points allotted to that subject will not be included in the *total maximum* of points, and the *percentage of excellence* will be calculated accordingly. Thus, a competitor who gains 760 points on a farm that is judged to need artificial drainage would receive a mark of excellence, 760 out of a possible 1,000—equivalent to 76 per cent.; but a competitor gaining the same number of points on a farm that is judged to need *no* artificial drainage would receive a mark of excellence, 760 out of a possible 950—equivalent to 80 per cent.

MIXED FARMS under 200 acres.

Order of merit.	Competitors.	Drainage.					Water conservation.						Fences, gates, roads.									Homestead.							
		Area.	Drains.	Difficulty.	Special merit.	Total.	Household.	Farmstead.	Paddocks.	Irrigation.	Water-power.	Total.	Style of fence.	Condition of fence.	Condition of gates.	Condition of roads.	Gates or slip-rails.	Hedges, stone walls.	Trees planted.	Special merit.	Total.	Plan, farmhouse.	Character, farmhouse.	Condition, farmhouse.	Plan, farm buildings.	Character, farm buildings.	Condition, farm buildings.	Special merit.	Total.
		15	15	15	5	50	20	20	20	10	10	80	5	5	5	5	5	5	5	5	40	6	6	6	6	6	6	4	40
1	Haywood, Bros.	10	15	15	5	45	20	20	20	...	...	60	5	5	5	5	4	...	5	5	34	6	6	6	5	5	4	4	36
2	Muscio, B.	10	15	15	...	40	20	20	20	...	...	60	5	5	5	5	5	5	5	3	38	6	4	6	6	4	6	4	36
3	Dening, E. J.	10	10	15	5	40	20	20	20	...	...	60	5	5	5	5	4	...	3	4	31	6	4	6	6	4	6	4	36
4	Johnson, J. W.	10	15	15	5	45	20	20	20	...	...	60	5	5	5	5	3	...	...	5	28	6	4	6	4	4	6	4	34
5	McLachlan, H.	...	...	...	...	...	20	20	20	...	...	60	5	5	5	5	3	5	...	3	31	6	6	6	4	4	4	4	34
6	Gibson, E.	15	10	5	5	35	20	20	20	...	...	60	5	5	5	5	3	...	1	4	28	6	6	6	6	4	4	2	34
7	Doust, D.	15	15	15	5	50	20	20	20	...	...	60	5	5	5	5	4	...	...	5	29	6	6	6	6	4	4	4	36
8	Green, G. K.	10	10	10	...	30	20	20	10	...	...	50	5	5	3	2	3	2	5	3	28	6	4	6	4	4	4	3	31
9	Waters, M.	...	...	...	...	...	20	20	10	...	...	50	5	5	5	5	3	...	2	...	25	4	4	4	4	3	4	2	25
10	Swan, W.	10	10	15	...	35	20	20	20	...	...	60	5	5	5	5	3	...	...	5	28	4	4	5	4	4	4	4	29

Mixed Farms under 200 acres.

Name	Implements.						System of cultivation and rotation.									Cleanness and cultivation.								Productiveness.				
	Tillage.	Harvest.	Marketing—Dairy.	Vehicles—Harness.	Special merit	Total.	Cereals.	Hay crops.	Fodder crops.	Potatoes, Pumpkins.	Special—Tobacco, Cane, Melons, &c.	Special merit.	Rotation.	Special merit.	Total.	Cleanness of cultivation.	Few rank weeds.	Clean fences.	Clean headland.	Special merit.	Method of cultivation.	Special merit.	Total.	Cereals.	Fodder—Pumpkins, Grass.	Potatoes, Cane—Special.	Special merit.	Total.
	15	15	15	10	5	60	10	10	10	10	10	10	10	10	80	40	5	5	5	5	30	10	100	15	15	15	5	50
Haywood Bros.	15	15	15	10	4	59	10	10	10	10	8	10	10	9	77	40	5	4	5	5	30	10	99	15	15	15	5	50
Muscio B.	15	10	15	10	3	53	10	10	10	10	10	10	10	10	80	40	3	5	5	3	30	10	96	15	15	15	5	50
Dening, E. J.	15	10	15	10	3	53	10	10	10	10	10	10	10	10	80	40	5	5	5	5	30	9	99	15	15	15	5	50
Johnson, J. W.	15	15	15	10	5	60	10	10	10	10	10	10	10	9	79	40	5	5	5	5	30	9	99	15	15	15	5	50
M'Lachlan, H.	15	12	15	10	...	52	10	10	10	10	10	9	10	9	78	40	5	4	4	4	30	9	96	15	15	15	5	50
Gibson, E.	10	10	15	10	2	47	10	10	10	10	...	10	10	8	68	40	4	5	5	4	30	8	96	14	15	15	5	49
Doust, D.	15	12	15	10	3	55	10	10	10	10	10	7	10	8	75	40	4	4	4	4	30	8	94	15	15	15	5	50
Green, G. K.	15	8	11	10	3	47	10	10	10	10	10	8	10	8	76	40	4	4	4	5	30	7	94	15	15	15	5	50
Waters, M.	15	5	12	10	3	45	10	10	10	10	10	9	10	9	78	40	4	4	5	4	30	10	97	15	15	15	5	50
Swan, W.	9	6	12	10	...	37	10	10	10	...	...	10	10	8	58	40	4	5	4	3	30	10	96	14	15	15	5	49

Mixed Farms under 200 acres.

Names.	Manures.									Conserving fodder.												Grass land.			Live-stock.					
	Farm-yard stables.	Farm-yard cows.	Farm-yard pigs.	Farm-yard fowls.	Field, ploughed in.	Rubbish gathered.	Mud, silt, fertilisers.	Special merit.	Total.	Resting grass paddocks.	Grass hay.	Cereal hay.	Ensilage.	Mowing machines.	Food preparation machines.	Horse power.	Barn.	Hay-shed.	Stacks.	Special merit.	Total.	Condition of pasture.	Special merit.	Total.	Plough-horses.	Light horses.	Cattle.	Swine.	*Sheep and special merit.	Total.
	5	5	5	5	5	5	5	15	50	5	5	5	10	5	5	5	5	5	5	5	60	15	5	20	10	10	10	10	10	50
Haywood Bros.	5	5	5	5	5	...	5	12	42	5	4	4	...	4	5	3	5	3	3	5	41	15	5	20	10	10	10	10	*9	49
Muscio B.	5	5	5	5	5	5	5	15	50	...	5	5	...	...	5	3	5	5	...	5	33	10	5	15	10	10	9	9	10	48
Dening E. J.	5	5	5	5	5	5	...	15	45	...	5	5	...	...	5	3	5	5	...	5	33	10	...	10	10	10	10	9	7	46
Johnson J. W.	5	4	5	5	5	5	...	13	42	...	5	5	...	...	5	3	5	5	...	5	33	5	...	5	10	10	9	9	7	45
M'Lachlan H.	5	3	4	5	5	5	5	12	44	...	5	5	...	5	5	3	5	...	...	5	33	5	5	10	10	10	9	8	8	45
Gibson E.	5	5	5	5	5	2	...	5	32	5	5	5	...	5	5	3	5	...	...	3	36	15	5	20	10	10	10	9	*10	49
Doust D.	4	3	4	5	5	...	5	14	40	...	5	5	...	5	...	3	5	5	...	5	33	5	...	5	10	8	8	8	5	39
Green G. K.	5	3	5	5	5	3	3	9	38	3	5	5	...	...	5	3	5	5	...	4	35	10	...	10	10	10	9	8	7	44
Waters M.	5	2	5	4	5	...	...	10	31	1	5	5	...	5	5	3	5	5	...	4	38	10	...	10	10	10	9	10	9	48
Swan W.	...	5	...	...	5	...	...	...	10	5	5	5	...	...	5	...	5	...	...	...	25	15	5	20	10	10	*10	...	10	40

Mixed Farms under 200 acres—*continued.*

Names	Garden & Orchard.				Bookkeeping.					Subsidiary aids.																					
	Kitchen garden.	Orchard.	Special merit.	Total.	Sales and purchases.	Ledger.	Farm data.	Balance-sheet.	Total.	Labour—Family.	Do. building.	Do. implement making.	Do. light repairs.	Do. heavy repairs.	Sales of dairy produce.	Do. poultry produce.	Do. honey.	Do. vegetables.	Do. fruits.	Do. cereal seed.	Do. garden seed.	Do. potatoes.	Do. nursery stock, grass, cane, &c.	Do. live stock.	Hire of implements, &c.	Meat and bacon.	Pig-breeding.	Poultry-keeping.	Butter-making.	Power—horse, water, steam.	Total.
	10	10	5	25	5	5	5	5	20	2	2	2	2	2	2	2	2	2	2	2	2	2	4	10	10	5	5	5	5	10	80
Haywood Bros.	10	9	5	24	5	...	5	...	10	2	...	2	2	1	2	2	2	2	2	2	2	2	3	9	5	5	5	5	5	5	65
Muscio B.	10	10	5	25	5	...	2	...	7	2	2	2	2	1	2	2	2	2	2	1	1	2	2	7	...	5	5	5	3	5	55
Dening E. J.	10	10	5	25	5	...	2	...	7	2	2	2	2	...	2	2	...	2	2	2	...	2	4	5	...	5	5	5	3	5	52
Johnson J. W.	4	4	...	8	5	...	2	...	7	2	...	2	2	2	2	2	...	1	1	2	...	2	2	7	...	5	5	5	3	5	50
M'Lachlan H.	8	8	...	16	5	...	2	...	7	2	2	2	2	...	2	2	...	1	1	1	...	1	2	7	...	5	5	5	3	5	48
Gibson E.	8	6	...	14	5	...	3	...	8	2	2	1	2	...	2	2	...	2	1	...	...	...	2	9	...	5	5	5	5	5	50
Doust D.	5	4	...	9	5	...	2	...	7	2	2	2	2	2	2	1	1	1	1	1	...	...	...	5	...	5	5	5	3	5	45
Green G. K.	9	9	5	23	5	...	2	...	7	2	2	1	2	...	2	2	2	2	2	2	1	2	2	6	...	5	5	5	3	5	53
Waters M.	10	5	...	15	5	...	2	...	7	2	2	1	2	...	2	2	...	2	2	2	1	2	...	9	1	4	5	5	3	5	52
Swan W....	2	2	...	4	5	...	2	...	7	2	2	...	2	...	2	2	...	1	...	1	...	...	2	6	...	5	...	5	...	...	30

MIXED FARMS under 200 acres—*continued.*

Names	Points of Interest.																	Management with a view to profit.										
	Experimental culture.	Nursery culture.	Fruit-culture.	Vegetable-culture.	Any new crop.	Power, steam, or water.	Superior implements of tillage.	Superior implements of harvesting.	Tool-shop.	Superior dairy.	Ensilage.	Green crops.	Superior pasture.	Laying down pasture.	Superior hay-barns.	Special merit.	Total.	Tillage.	Cropping.	Live stock.	Marketing of farm produce.	Marketing of dairy produce.	Marketing of orchard produce.	Co-operative labour.	Home repairs, &c.	Class of machinery.	Special merit.	Total.
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5	20	10	10	10	10	10	10	10	10	10	35	125
Haywood Brothers	...	...	1	1	...	...	1	...	1	1	...	1	1	1	1	5	14	10	10	10	10	10	5	10	5	9	35	114
Muscio B.	1	1	1	1	...	...	1	...	1	1	...	1	...	1	1	5	15	10	10	10	10	10	10	10	8	9	33	120
Dening E. J.	1	1	1	1	1	...	...	...	1	...	...	1	...	...	1	5	13	10	10	10	10	10	8	10	8	8	35	119
Johnson J. W.	1	...	...	1	...	...	1	...	1	...	...	1	...	...	...	5	10	10	10	10	10	10	...	10	10	10	35	115
M'Lachlan H....	1	...	...	1	...	...	1	...	1	...	...	1	...	...	...	5	10	10	10	10	10	10	...	10	5	9	35	109
Gibson E.	...	...	...	...	...	...	...	...	...	1	...	1	1	1	...	5	9	10	10	10	10	10	5	10	5	10	35	115
Doust D.	1	...	...	1	1	...	...	...	1	1	...	1	...	...	1	5	12	10	10	10	10	10	...	10	10	8	30	108
Green G. K.	1	...	1	1	...	...	...	1	1	...	...	1	1	1	...	5	13	10	10	7	9	9	9	10	8	9	34	110
Waters M.	1	...	...	1	...	...	...	1	...	...	...	1	1	1	1	5	12	10	10	10	10	5	5	10	5	8	32	105
Swan W.	...	...	...	...	...	...	...	...	...	...	1	...	1	1	...	5	8	10	10	10	10	10	...	9	...	...	35	94

Practical Vegetable Growing.

Directions for the Month of April.

In many portions of New South Wales the weather becomes very cool during April, and not infrequently rain prevents much work being done in the garden. Advantage of fine weather should be taken to dig up new ground and make it ready for planting and sowing. Not a weed should be allowed to grow, and all old and useless vegetables and remains of vegetables should be gathered together and either burnt or allowed to rot and make good compost for the garden. If burnt, the ashes should be carefully preserved, spread over the ground and dug in.

In some of the warmest of the coast districts many vegetables may be grown, which it would be quite impossible to raise in the cool climates. This is the case with French beans, which the writer has seen growing well and producing freely in the middle of June in the Tweed and Richmond Rivers districts. Such productions should be of considerable value if it were possible to send them to the metropolitan markets. Tomatoes also grow wild in some favoured localities, and bear fruit throughout the year. This may seem surprising to those who live in districts subject to severe frosts, snows, and ice. For its small area this Colony is a truly wonderful country, having almost every climate under the sun, from the extreme Alpine cold of Kosciusko to the almost tropical heat of the Tweed.

Vegetables such as cabbages, cauliflowers, &c., should be kept quite free from weeds, and the ground between the rows should be chipped up with a hoe as often as can be done conveniently, but not whilst the ground is very wet, for this would make it into a sort of paste. If the vegetables are not growing as well as should be expected, it is recommended that some liquid manure should be given them. This can be made from the droppings of cow, horse, sheep, or fowls. The sheep manure is very strong, and it dissolves better than any other of the above-mentioned manures. It very often contains a vast quantity of seeds of weeds, and for this reason it is as well perhaps to use it in a liquid state, for after mixing and stirring it up well in the water it can be strained without difficulty, and the seeds will either be removed or else settle at the bottom of the vessel containing the liquid. Fowl manure, used fresh, makes an excellent liquid manure. A little experience will soon show what strength may be used with impunity. Do not pour liquid manure over the leaves of vegetables, for it will quite injure some kinds. It may be as well to mention that in digging or hoeing between vegetables the soil should not be allowed to fall or be sprinkled over the leaves, more particularly if they are wet with rain or dew.

There should be no need for the use of artificial manures for the farm vegetable garden, as enough animal droppings are almost sure to be available. But if it becomes necessary to use the former, great caution should be exercised so as not to make liquid manure with them too

strong, or apply them in a dry state too thickly. An ounce, or even half an ounce, to a gallon of water will be found quite strong enough for any vegetable. A great aid to the growing of good vegetables is the mulch. This can be made of horse or cow droppings, half rotten straw, leaves, or grass, either alone or mixed up together. The use of a mulch, particularly in dry weather, makes a wonderful difference. If it be possible to save the urine from the cows and horses, it would be most desirable to do so as this forms the best of liquid manure mixed with water. If it be used quite fresh, it may be applied much stronger than if it be kept in a vessel and allowed to ferment.

Asparagus.—Some ground should be made ready for planting this excellent vegetable. It need not be planted until towards the spring, but if the ground is dug up roughly and manured some time ahead, it will become more fit for the plants than if prepared immediately before planting. As the asparagus is a permanent crop, and will last for many years, it would be advisable to take some trouble in digging and manuring the ground; and although its thick fleshy roots are to a great extent surface feeders, and do not descend very deep in search of food, the ground had better be dug 2 feet or at least 18 inches deep, and if the soil is poor, manure may be mixed in at the same time. Coarse bone meal or broken up bones would be useful in addition to farm-yard manure. There is no necessity to put on a heavy dressing of manure, and if the soil is in "good heart" it may not require any. To provide sufficient asparagus for a fair sized family, very little space would be required, say about 15 feet long by 6 feet in width, or even less, but this must be left to individual judgment and convenience for even a dozen well cared, for plants will yield a considerable return. A few plants may perhaps be tried at first, and if the vegetable is appreciated and succeeds satisfactorily more can be planted afterwards.

Beans, Broad.—This vegetable may be sown largely from time to time during the month. It will attain the greatest perfection on rather stiff soil, but a fair crop can be obtained from almost any soil if it be well manured. Sulphate of ammonia is not a desirable manure to apply. Sow the seed in rows about 3 to 4 feet apart, the seed about 4 inches apart in the rows, and about an inch and a half deep. Johnson's wonderful and broad Windsor are both excellent varieties. The dwarf fan bean is a good variety very suitable for small gardens. The rows of this should be about 1 foot apart.

Beans, French or Kidney.—Will only succeed in the warmest parts of the Colony where frosts cannot attack them.

Beet, Red and Silver.—Thin out well the plants which are coming up, and keep the rows free from weeds. It is not advisable to sow any more seed at present.

Borecole or Kale.—A very small quantity of seed may be sown. This is a vegetable hardly worth the growing, for good cabbages are infinitely superior.

Brussels Sprouts.—Which is a sort of cabbage, is one of the best if not the best of that class. It will succeed well in cool climates, and may be treated in every respect as the ordinary cabbage. A little seed may be sown, and if any young plants are obtainable they should be planted out about 2 feet apart each way.

Cabbage.—Sow seed as largely as may be thought necessary, plant out also any young cabbages that may be available. They should not be pulled out

of the seed bed, but taken up carefully without breaking more roots than can be avoided. The early Jersey Wakefield and early dwarf York are both good small varieties. The sugar-loaf is also a good kind. Every garden should have a few plants of the red cabbage, which comes in very useful for pickling. If not required for that purpose, it may be eaten in the ordinary way. It should be noted that cabbages are greedy feeders, and need rich soil and abundance of manure.

Cauliflower.—Sow a little seed, and plant out from the seed bed any strong plants that are large enough to handle. This vegetable should be grown largely, for it is well liked by almost everyone. The ground needs to be well manured like cabbage.

Carrot.—Seed may be sown largely. Make the rows about 1 foot apart, and take care not to bury the seed more than half an inch deep. Be careful to weed frequently, for the seed takes a considerable time to come up, and when it does, the plants are very fine and tender and easily destroyed by weeds. Manure had better not be applied, unless it is old and very rotten, as it induces the carrots to become forked and quite spoiled in appearance. Early Shorthorn and Improved Intermediate are good varieties to sow at the present time.

Celery.—Plant out a few seedlings into very well manured ground, if any are available.

Endive.—If plants are available they may be planted out largely. It is a most useful substitute for lettuce when that cannot be grown. A little seed may be sown.

Leek.—Seed may be sown largely, and any plants from previous sowings that are large enough, say about 6 inches in height, may be planted out. The soil should be heavily manured.

Lettuce.—Sow seed largely, and plant out any young lettuces that are suitable and of sufficient size to handle. The roots should not be broken, if possible, when raising the plants from the seed-bed.

Onion.—This is an important and useful vegetable, and opportunity should be taken now to sow a good quantity of seed. Sandy loam is the most suitable soil for the plant. Well rotted manure should be applied in quantity, the land well drained, and the surface kept somewhat raised and made clean and fine for the seed. The beds should be narrow, so that they can be easily weeded. It should be kept in mind that weeds have a most damaging effect on young onion plants, and must never be allowed to grow and attain any size. The seed should be sown in drills, which should be about 1 foot apart. Care should be taken not to bury the seed deep—indeed it should be little more than pressed into the soil. Sow thin, unless small onions are required.

Parsely.—Sow a small quantity of seed in order to keep up a supply of plants.

Parsnip.—This is a good wholesome vegetable, although not always liked. Sow a few short rows. The ground should be dug deep, as the roots will extend to a great depth, if the soil is free and open.

Peas.—Take the opportunity to sow largely of this general favourite in rows about 3 feet apart. Cover the seed with soil to a not greater depth than 3 inches. The peas should be sown in the drills about 3 inches apart. For manure use well rotted droppings from farm animals. Lime, especially sulphate of lime or gypsum, will be found useful. Potash and superphosphate of lime are good manures to use.

Radish.—Keep on sowing a very little seed from time to time, and root out all old tough plants. Use plenty of well rotted manure.

Spinach.—A little seed may be sown occasionally during the month. Sow in rows about 18 inches apart, and thin out the young plants well when they come up. Use well rotted manure freely.

Shallots.—Plant out a few bulbs, but do not set them deep in the ground. They should stand about a foot or so apart each way. Whatever distance you may think best keep to it, or else everything will have a most unsatisfactory appearance, and be awkward to work. A line should be used on every occasion.

Herbs.—Sow a little seed of any kind it may be wished to grow.

Orchard Notes for April.

The month of April is more or less a slack time for fruit-growers in the coastal districts, as the bulk of the summer or deciduous fruits have been disposed of, and the citrus fruits are not yet ready. There will, however, still be a certain amount of fruit to dispose of, such as late apples and pears, passion fruit, and persimmons, with a few off-crop oranges, lemons, and thorny mandarins. Though there is not much fruit to send to the market during the month, that is no reason why it should not be carefully and attractively packed, so as to show to the best advantage, as it should always be borne in mind that the better the fruit opens up when exposed for sale the more readily it will sell, and the better price it will bring.

During the month the cultivation of the orchard should be attended to, and the ground kept in good tilth and free from weeds. If, during the month there is any spare time, it can be well utilised by doing a little necessary draining, and there is nothing that will pay the orchardist better, especially in the Cumberland district. Drain tiles are always preferable to use, as they are cheaper to lay, last longer, and do more good if properly laid than any other kind of drain. There is no occasion to lay the drains too deep, as a rule drains 30 inches deep and 20 feet apart are the best. On heavy soils liming should supplement draining. All surface drains should be attended to, and where there are underground drains the outlets should be examined so as to see that there is a good get away for the water. In the latter districts all late apples and pears should be gathered and stored for winter use, taking care to handle the fruit as carefully as possible, and to store nothing but perfectly sound fruit. All bruised, blemished, or wormy fruit must be rigidly excluded, as if mixed with the sound fruit, it will not only rot itself, but in rotting will probably cause several adjacent fruit otherwise perfectly sound to rot also. The fruit containing codlin moth should be carefully excluded from the sound fruit and destroyed, and the building used to store the fruit should be so arranged as to offer as little shelter as possible to the larvæ of the moth. If there is time, all fruit cases should be carefully disinfected, as this will destroy many forms of disease, both insect and fungus, and if done well before they are required for citrus fruit, they are not likely to be overlooked, which will very probably be the case if left till spring. The best way to disinfect the cases is to immerse them in boiling water for not less than five minutes, which will effectually destroy all fungus germs or insects. A shorter immersion would not be sufficient, especially in the case of the codlin moth, as the larvæ is so well protected by its covering that it is difficult to reach. If fungus diseases of any kind or pear mite have been prevalent in the orchard during the season, vast numbers of the spores (seeds) of the fungi and large numbers of the pear mite may be easily and readily destroyed by gathering up and burning the fallen leaves of the diseased trees, so that when this can be done it should always be attended to. No diseased

or rotting fruit should be allowed to lie under the trees, as it is simply breeding disease. This is especially so in the case of the bitter rot of the apple, where it is the chief means of spreading the disease, so that all rotting and diseased fruits should be gathered up and destroyed by burning.

All dead, diseased, or undesirable trees that are to be removed from the orchard can be dug up during the month, and the hole from which they have been dug can be left open, and the adjacent ground left in a rough state, in order to expose as great a surface as possible, so that the ground may be thoroughly sweetened before planting a young tree in the place of the one removed. The work in the orchard nursery will consist mainly in keeping the land in good order and free from weeds, as the young trees are not likely to make much more growth, but have only to mature their wood.

General Notes.

Cool Buildings.

It is often remarked by new-comers to the Northern Australian colonies that very little attention is given to the construction of buildings with a view to coolness during the almost tropical heat of our summers.

In older settled countries, having a similar range of temperature to ours, the buildings are of a much more solid construction, massive walls and substantial roofings are relied upon to moderate the temperature, while the buildings themselves are so arranged in clusters or groups as to ensure currents of air circulating amongst them.

In Canada and the North-west States of America houses and barns, stables and stores, are built of logs squared on two faces with the adze, and where timber is not sufficiently plentiful to permit of this, "dug outs" are made on hill sides, the solid earth forming the walls on three sides, and the roofs are covered with grass sods, forming a sure protection against the summer heats as well as the winter cold.

In Central America as well as in Egypt and many other hot climates, walls of dwellings are constructed of considerable thickness, built of adobé or unburnt bricks. Some of these are reported by recent travellers to be of very great age and still perfect, and it is said that the interiors of these adobé buildings are of marvellous coolness.

One of the great difficulties which dairying in this Colony, and especially in the northern part of it, has to contend with is the heat and the great variation in the temperature from day to day and at various times of the same day.

A great point of excellence in both butter and cheese is uniformity of quality and flavour, and it is extremely difficult to secure uniformity in a dairy where the temperature is constantly subject to great variations. Some of the dairy companies have gone to great expense in order to avoid these changes of temperature by double walls, deep verandahs, &c.

Want of capital is usually pleaded as the reason why farmers and selectors do not erect more substantial buildings; but it is quite possible that if it was more generally known that solid structures, cool in summer and warm in winter, can be built at the same, or even at less, cost than those now generally put up, many of our farmers would build them in preference.

A representative of this Department calling at the farm of Mr. Thos. Rixon, East View, Rocky River, on business on a very hot day, was much struck with the coolness of the room in which he was received, and, remarking upon it, was told by Mr. Rixon that it was built of mud, and was always cool, that he had built several such, and was about to build a similar one as a dairy for E. C. Bloomfield, Esq., of Salisbury Court.

Mr. Rixon very readily entered into particulars, which we publish in the hope that they will prove useful to our readers; and we shall be glad if any who have had experience of such buildings will supply us with further information on the subject.

Mr. Rixon said it did not require any extraordinary skill to build them; any man of average ability could do it. "It is quite simple. We take fine ironstone gravel, mixed with some earth, or just as it would come from the pit, top and all. We mix it like mortar, and we mostly put in some short rotten straw or chaff to make it hang together, and use a potato fork to put it up with. You want a stone foundation and some galvanised iron to cover it up with, and that is about all there is in it."

It is in fact concrete building made without cement, the ironstone gravel forming the concrete. All who have had much to do in breaking up new land have found patches of ground which, when worked at all wet, will cake as hard as cement in the next dry spell. That is the sort of soil to use. It is pretty plentiful in patches in most parts of the Colony. Some volcanic sands found in Italy have the same property, and are used in making cements which have a good reputation.

The method of building is shortly this: the foundation is dug out to a sufficient depth, according to the nature of the subsoil; in some it is needful to lay a course of rough stones (rubble). The tempered mud and gravel is then laid about a foot in depth and not less than 15 inches in width, boards or slabs being used to keep the sides even. This is completed round the walls; door-sills, and frames being put in their proper positions. In wet weather it is necessary to protect the concrete from rain, and in very hot weather it should be shaded from the sun to prevent too rapid drying. Where ventilation is desired it is well to make a wooden frame of the size desired, and bed it in about a foot from the outside ground-level. The opening thus left may be protected with wire-gauze or perforated zinc or tin, to prevent the entrance of insects and reptiles (snakes, frogs, lizards, &c.)

The first course having been laid, and having become sufficiently firm to carry the next, the process is repeated, window sills and frames being built in where required. When the walls have been completed to the desired height, the wall-plates are put in position and the roof put on in the usual way. Mr. Rixon has roofed his own place with straw-thatching, which in some circumstances is the best possible roofing, being impervious to heat, perfectly water-tight, and very durable; but it has some disadvantages. In some places, it affords harbour for vermin and sparrows, and where grass, cane-trash corn-stalk, or scrub are being burned off, or bush-fires are raging it is rather risky. Where there is a liability to these risks a galvanized-iron roof is much safer, and not much more costly.

The great objection to iron-roofing is that the heat from it strikes downwards during the day, and condensed moisture drips from it at night; but both these faults can be obviated at a slight expense by a lining of glazed calico or hessian, or stiff paper nailed to the under side of the rafters leaving a clear space of some 4 inches or more between it and the iron.

This space is of course an air-space, and the air in it will be kept in motion by the heat of the iron heating the air, which will, being lighter, find its way up to and out at the ridge capping, and its place will be taken by cooler air entering at the eaves, and so a constant current will be kept up. The air in the building will be always cool, and there will be no condensation of moisture to cause a drip at night.

The Willesden Paper-mills, near London, made several kinds of paper suitable for this purpose, and the Australian Asbestos Company of Melbourne make several fabrics well adapted for it, and also for roofing purposes. Almost any storekeeper can supply, or procure, a packing-paper glazed with black varnish on one side, such as is used in packing goods for shipment;

but any moderately tough paper will answer the purpose, which is simply to maintain a moving body of air between the iron and itself. There is no strain on it.

The importance of cool places on a homestead can scarcely be over-estimated. A cool dairy is essential to the making of good butter and cheese; a cool place is wanted for storing fruit, for curing bacon, and for keeping provisions, and for sorting, bulking, and curing tobacco-leaf. A cool dry place for the latter purpose will make a penny per pound difference in the value of the crop.

Mr. Bloomfield was good enough to answer our inquiry as to how the dairy answered its purpose, and said: "The dairy built of mud for me by Mr. Thomas Rixon is proving very satisfactory; the temperature is even, and the dairy is 10 degrees cooler than any other building on the place. The cost is much less than I could have got it built for of any other material."

Insects for Identification.

Attention is again drawn to the collection of insects, friends and foes, being formed by this Department, and for this purpose the Entomologist invites communication upon insects of economic interest whose attacks affect the well-being of plants and fruits; in return, early advice as to remedies and preventives will be forwarded.

All correspondence should be accompanied by specimens of the pests to which reference is made, and also, if possible, by material—whether fruit, foliage, grain, or timber—illustrating the manner in which the harm is done. Whenever possible the insects should be sent alive, securely packed in tin or wooden boxes, in which they may be sent through the post with safety. On no account should cardboard boxes be used for posting specimens, as in almost every case they arrive broken and the insects destroyed by the rough handling of the post. The early stages of many insects cannot be determined definitely unless accompanied by the mature or perfect insects, and this is an additional reason for sending caterpillars, grubs, &c., alive, and also accompanied by food, as in many cases they can be kept until they undergo their transformations and arrive at maturity.

The Moreton Bay Fig as a Fodder Plant.

(See August Gazette, 1893, page 609.)

Mr. W. Rae, of Sydney, writes:—

Re Mr. Maiden's account of the Moreton Bay fig as a fodder plant for cattle, I beg to offer a few remarks thereon. Though, perhaps, somewhat limited, it is none the less thorough. I may say I first came to the conclusion like Mr. Maiden, from seeing them eat them when thrown in their way, and I thought to myself, "Well, when they are so fond of them they must be good, although a bit gummy." The result of my observations was, I would give them a trial, although warned repeatedly not to do so, as it would give the milk a disagreeable taste, and lead to constipation in the cows. However, I thought differently, and carried on in secret for some time—about six weeks—during which time they received them almost every day. I then said I would give them a trial, although told the same old story of tainted milk and injured cow. You can judge of their surprise, then, when I told them I had been using the leaves for some time, and the milk had no ill effects or taste perceptible.

I have been feeding all the winter regularly, with the addition only of a little lucerne, and what grass they pick up; but, as Mr. Maiden says, it is not much if there are any leaves about, although I shut them out from the leaves sometimes a few hours daily, as I thought it might act as a sort of corrective against the eating of the leaves. However, I have no cause to regret giving them, as the increased supply of milk amply testifies to their merits as a milk-producing fodder plant or tree.

I may say it is very direct in action—so much, that it will double the supply in twenty-four hours, and also keep up the condition as well. As for the milk, I confess it is tainted, but not perceptibly unless attention is drawn to it. It seems a bit glossy to the palate, and leaves a somewhat dry feeling in the mouth after. I may say I have tasted the pure milk from the tree, and was much surprised to find that it was not in the least like the gummy, sticky substance I had met with on hands and clothing. When taken internally it seems to lose all those properties it has when exposed to the air. It was not in the least disagreeable, although somewhat dry to the palate. I am inclined to think myself it is somewhat of a laxative nature.

I may also say the cows drank a great deal more water when eating the leaves—so appreciable, that it might cause different results if denied them. This only applies to the large-leaved, although they take the small as well, but not with the same relish, as they are not of such a succulent nature. I think they ought to be more liberally distributed over pastures and reserves where cattle have access. There will then be no cause to complain of the immense number of leaves which large trees shed.

AGRICULTURAL SOCIETIES SHOWS, 1894.

Society.	Secretary.	Date.
Tenterfield P., A., M., and H. Society	J. Hawken	Feb. 27, 28, and Mar. 1.
Port Macquarie A. and H. Society	A. E. Poutney	Feb. 28 and Mar. 1.
Lismore A. and H. Society	C. S. Connor	,, 28 and Mar 1, 2.
Berrima District (Moss Vale) A., H., and I. Society	J. Yeo	Mar. 1, 2, 3.
Nepean District (Penrith) A., H., and I. Society	R. Benaud	,, 1, 2, 3.
Robertson Agricultural Society	R. J. Ferguson	,, 6, 7.
Uralla P. and A. Association	J. D. Leece	,, 6, 7.
Bega A., P., and H. Society	A. P. Wilson	,, 7, 8.
Inverell P. and A. Association	J. M'Ilveen	,, 8, 9.
Picton Agricultural Society	G. Bradbury	,, 8, 9.
Cobargo A. and P. Society	J. Graham	,, 13, 14.
Tumberumba P. and A. Society	W. Willans	,, 13, 14.
Glen Innes P., A., and M. Association	J. Denshire	,, 14, 15.
Camden A., H., and I. Society	W. R. Cowper	,, 14, 15.
Goulburn Agricultural Society	J. J. Roberts	,, 15, 16.
Gulgong Agricultural Association	T. Turner	,, 16, 17.
Armidale (Combined Show), New England, A. and P. Association	W. H. Allingham	,, 20, 21, 22.
The Royal Agricultural Society (Sydney), N.S.W.	F. Webster	,, 21 to 27.
Braidwood P. and A. Association	G. F. Taylor	,, 22, 23.
Castle Hill A. and H. Association	F. H. G. Rogers	,, 26, 27.
Orange A. and P. Association	J. S. Thomas	,, 28, 29.
Walcha P. and A. Association	H. Chapman	April 4, 5.
Lower Clarence (Maclean) Agricultural Society	J. S. Dunnet	,, 4, 5.
Gundagai P. and A. Society	W. E. Kyle	,, 5, 6.
Blayney P. and A. Society	G. H. Woolley	,, 5, 6.
Gundaroo P., A., and H. Association	J. Affleck	,, 6.
Namoi (Narrabri) P., A., and H. Association	J. Riddle	,, 11, 12.
Bathurst A., H., and P. Association	W. G. Thompson	,, 11, 12, 13.
Clarence (Grafton) P. and A. Society	T. Page	,, 18, 19.
Wellington P. and A. Association	R. Porter	,, 18, 19.
Hunter River (West Maitland) A. and H. Association	W. C. Quinton	,, 18, 19, 20.
Dubbo P., A., and H. Association	G. H. Taylor	,, 24, 25, 26.
Warialda P. and A. Association	W. B. Giddes	,, 26, 27.
Mudgee Agricultural Society	J. M. Cox	,, 26, 27.
Macleay (Kempsey) A. and H. Association	H. R Gray	May 9, 10, 11.
Upper Hunter (Muswellbrook) A. and H. Association	Pierce Healey	,, 16, 17.
Upper Manning (Wingham) A. and H. Society	J. J. Herkes	,, 16, 17, 18.
Cobar P. and A. Association	A. Roxburgh	June 13, 14.
Forbes P., A., and H. Association	W. G. Domling	Aug. 9, 10.
Northern (Singleton) Agricultural Association	C. Poppenhagen	,, 15, 16.
Cowra P., A., and H. Association	S. Wright	Sept. 5, 6.

N.B.—Secretaries of Societies are here asked to forward dates of forthcoming Shows as soon as decided upon to enable an early insertion by the Department in the *Agricultural Gazette.*

[2 plates.]

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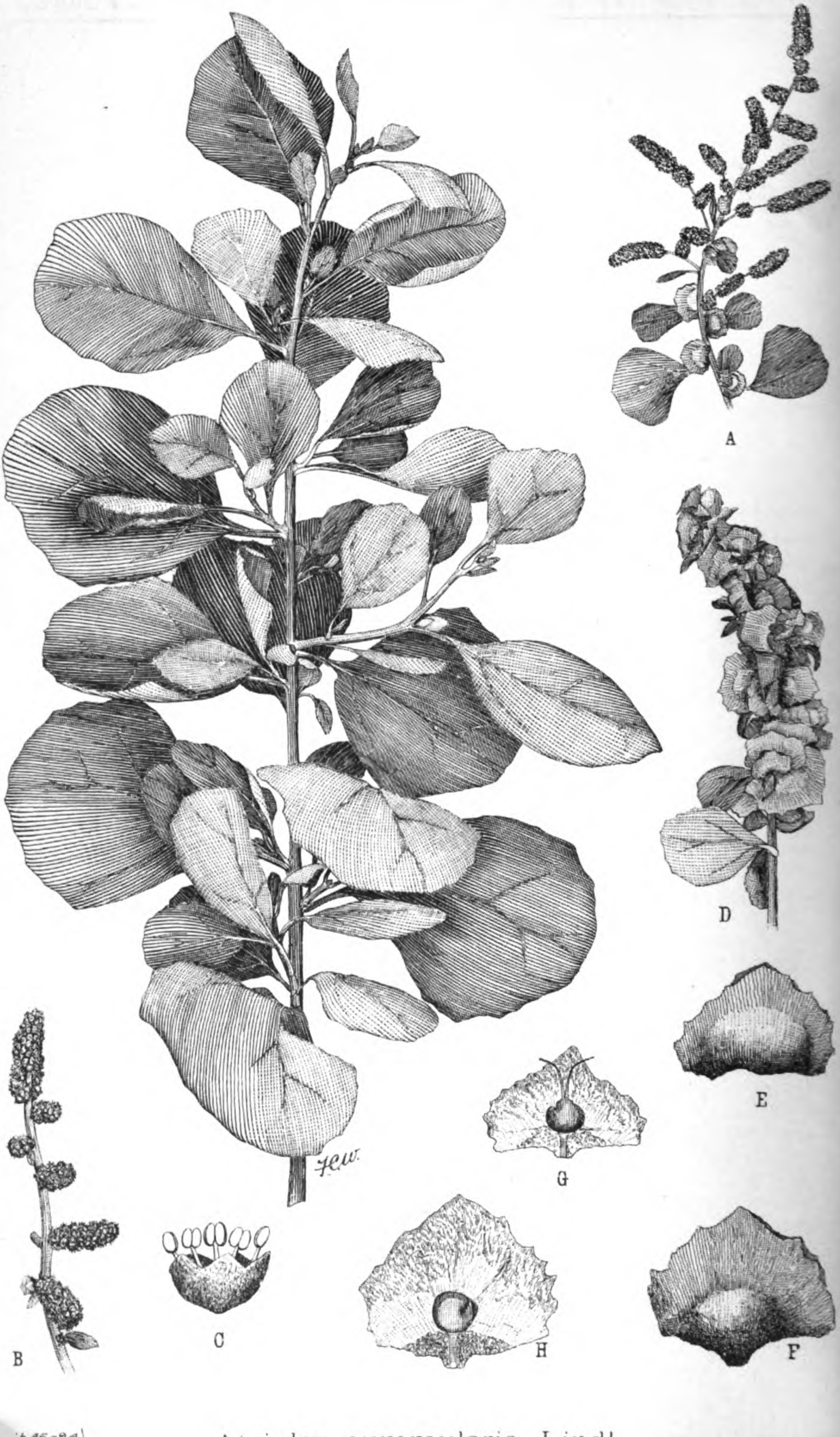
CONTENTS.

ERRATA.

Part III, page 188, line 6 from bottom, *for* "22 ft." *read* "32 feet."

" " 188, line 27, *for* "two and three rail" *read* "3 and 4 rail."



Atriplex nummularia, Lindl.

"An Old Man Salt-bush."

Useful Australian Plants.

BY J. H. MAIDEN,
Consulting Botanist.

No. 9. AN OLD MAN SALT-BUSH.

(*Atriplex nummularia*, Lindl.)

Preliminary Note.—Salt-bushes belong to the natural order Chenopodiaceæ or Salsolaceæ, which are synonymous terms employed by different authors. The first term is in allusion to *Chenopodium*, one of the genera comprised in it, and the other is called after another genus, *Salsola*. The salt-bush family includes a number of plants which appear to most people very dissimilar. The salt-bushes, of course, include many plants varied in appearance and size. Allied to these are the cotton-bush, and some rather fibrous plants which are apt to give sheep indigestion, while a third group consists of succulent plants, which grow on salt or brackish marsh land. Instances of these are *Salsola* and *Suaeda*, kinds of samphire, which are occasionally used for pickling. Allied to these are some utterly worthless weeds, some native, some introduced, some ill-smelling, and some yielding abundance of seed, and hence hard to eradicate. As it is contemplated to figure and describe other salt-bushes and their allies, readers of the *Gazette* are invited to send fresh flowering or fruiting twigs of any of them to the Department, They will carry in a cigar-box, a tin canister, or even rolled up in a sheet of newspaper, and will go through the post for a trifle. Any notes in regard to their occurrence in a particular locality, or any other points deemed of interest, will be appreciated and acknowledged.

Vernacular Names.—I use the term "*An* Old Man Salt-bush," because there is another "Old Man Salt-bush" (usually cut down to "Old Man," as busy Australians are not inclined to employ four words where two will suffice), whose botanical name is *Rhagodia parabolica*. Our plant is also known as "Cabbage Salt-bush," as it is often employed as a substitute for that useful vegetable.

Botanical Name.—*Atriplex* is the Latin name for a herb known as Orache, a plant which, like our salt-bush, is now included by botanists under the genus *Atriplex*. *Nummularia* is also a Latin word, and signifies "coin-like," in allusion to the shape of the leaves.

Value as a fodder-plant.—This is one of the plants whose value as a fodder-plant it would not be easy to exaggerate. Its advantages are that it is nutritious, it yields an enormous quantity of feed in a short time, it seeds enormously, and it may readily be propagated by cuttings. It has been so much appreciated that it is getting scarce. No one in Australia disputes its value, but it is desirable occasionally to remind our people of the worth of our native vegetation. If we are not careful, there are some native plants (of which this may be one), that we shall have to import from other countries.

To avoid useless repetition, I simply refer the reader to Mr. Alston's notes below on the propagation of this plant by seed and other cognate matters.

The leaves make an excellent substitute for spinach or cabbage. This fact should be more widely known.

The chief value of this salt-bush will, of course, be to the pastoralist, who would like to have it on a large scale, but there are many people who may like to try it on a small scale. For instance, where sufficient cannot be grown to form a large proportion of the diet of an animal (as, for instance, in the case of those dwellers in towns or suburbs who keep a cow or a horse), a few bushes about the place will be found most appetising fodder, and to form a convenient medium for administering part of the salt necessary for healthy existence, but care must be taken to keep the salt-bushes where herbivorous animals cannot break them down and devour them. If a moderate amount of care be exercised in cutting down or breaking off the branches, the salt-bush, whose foliage is of a mealy whiteness which is ornamental, will preserve its shapely appearance for a considerable time.

The following analysis of a sample of this salt-bush from the Narrandera district is by Mr. W. A. Dixon (Proc. Royal Society, N.S.W., 1880, p. 138) :—

Oil	2·18
Carbo-hydrates	42·85
Albuminoids	16·45
Woody fibre	7·24
Ash (reckoned as carbonates)	31·28
	100·00
Nitrogen	2·63
Woody parts of plant	10 per cent.
Edible	90 „

An analysis of the ash is also given.

Following is an analysis of the Cape Salt-bush (*A. halimus*), by Mr. Charles F. Juritz, M.A., Analyst to the Department of Agriculture of Cape Colony :—

Carbo-hydrates	63·37
Albuminoids	4·78
Woody fibre	7·98
Ash	23·87
	100·00

Comparing these results with those obtained by Mr. Dixon for *A. nummularia*, Mr. Juritz remarks :—"It will be observed that, according to the above results, the carbo-hydrates, which constitute the fat-forming material *par excellence* in plants, are more abundant in the Cape plant. The Australian salt-bush, on the other hand, contains a good deal more albuminoid, *i.e.*, nitrogenous or strength-giving constituents." (*Agric. Journ.*, Cape, 15th June, 1893, p. 223).

But I would warn pastoralists against comparing the two analyses too closely. They have been made by two different chemists, who may have operated upon plants in different stages of development, and the raw material may have differed in various ways.

The Old-Man Salt-bush at the Cape.—On the principle, I suppose, that "a prophet is not without honour, save in his own country," our good friends at the Cape are paying more attention to, and seem altogether more appreciative of this valuable plant than we are. The following notes are taken

from the *Agricultural Journal*, 18th May, 1893, p. 178 (the official organ of the Department of Agriculture of the Cape of Good Hope). The report is by Mr. E. Garwood Alston, of Van Wyk's Vlei Estate:—

"In April, 1886, we received six seeds of *Atriplex halimoides*, one of the Australian salt-bushes, for trial here. Only two came up; one died before reaching maturity, and the other represents the mother plant of all the *A. halimoides* found in this country.

"Later on we received from Professor MacOwan, a second packet of *A. halimoides* and also *A. nummularia*, but as we had established the first named, only *A. nummularia* was sown, with the result that in a year's time we were in possession of a patch large enough to supply seeds in fair quantities to farmers and others. (The original seeds were sent by Baron von Mueller.) All the seeds were sown from half an inch to one inch deep in brackish clay soil, and after the plant once commenced to mature its seed, it propagated itself rapidly enough to enable us to keep up the supply in spite of heavy demands every year.

"I should not like to say that, as a fodder plant, the Australian species is better than our own *A. halimus*, but the popular idea locally is that the Australian species is less salt, and consequently more can be eaten by cattle and sheep.

"Our own preference for the stranger is caused by the larger quantity of food produced in a given time, its capability for seeding profusely for nine months out of the twelve, and the ease with which it can be raised. At Van Wyk's Vlei the following animals feed on it in preference to our native *Atriplex*:—Cattle, horses, donkeys, sheep, goats, pigs, fowls, and even ants! It is just possible that the reason may lie in the ability of *A. halimus* to absorb more saline matter from the soil than its cousins; and, if so, it is *primâ facie* an argument in favour of the Cape plant being sown in preference to the Australian where there is but little salt in the soil.

"The drawback to the Cape species is the small number of fertile seeds it yields yearly, and its failure to find out the defensive habit its cousins have acquired to keep the soil cool and moist for the seedlings, by dropping over them a heavy mulching of withered leaves and seed. Apparently *A. halimus* is more particular in the choice of soil than those now acclimatised, but on this point I should like more information.

"During drought I have known cattle, horses, and sheep to browse and thrive upon these Australian fodder plants, a most decided preference being given to them, although the surrounding ground was covered with other species of salt-bushes."

Mr. Alston then gives an account of the extensive introduction of this species into the Orange Free State and the Transvaal, to say nothing of its distribution over Cape Colony. Between January, 1892, and January, 1893, Mr. Alston supplied the Government of the Orange Free State with four woolpacks of the seed.

"Up to this time we had been supplying seeds by post 1s. per lb., which included cost of collection, bag, and postage; at 3s. 6d. per grain bag (say 20 lb.); 23s. 3d. per woolpack (say 150 lb.), and the same price obtains now. The number of seeds to a pound, when dry, is about 25,800 gross, and 20,000 net (matured)."

If Mr. Alston can supply seeds in this quantity, and at this price, four or five years after the introduction of this salt-bush to Cape Colony, surely some of our enterprising seedsmen can do the like for New South Wales. Cannot they specially bring the matter under the notice of their customers throughout the length and breadth of the land? It is to be

hoped that another season may not be allowed to pass without a special effort being made to replant large areas with this valuable salt-bush. I should think it would be an ideal plant to extensively disseminate in the vicinity of the artesian bores.

I give a few more of Mr. Alston's notes :—

"The seed may be sown at any time during the spring, summer, and autumn months; is not over particular as to class of soil, but prefers and grows most luxuriantly on moist, brackish patches.

"To sow the seed broadcast is very wasteful and unsatisfactory, the use of a spade or light hoe to lift the soil slightly, and inverting a thorny bush over the spot after sowing, is trouble well repaid.

"When the object in view is to make use of old and worthless lands, they should be ploughed but not harrowed. The seed should be sown in small patches (say, 50 yards apart), from half-an-inch to an inch deep, and well protected against sheep and cattle till the stem of the plant is too hard for them to eat. A light mulching of straw or similar material prevents too rapid evaporation, and in clay soils the pinching of the leader stem of the seedling. The spread of the bush on tilled ground is rapid; hence the advice to sow small patches, a foresight which enables the farmer to look after it better and use less seed and water.

"The plant stands drought, and a minimum temperature of 14 degrees."

The Old Man Salt-bush in India.—The following account of the experiments which are being made to introduce this most valuable plant into India will be found interesting. It is taken from the report on the Botanical Gardens, Saharunpur and Mussoorie, 1883-84, p. 8, as quoted in the "Dictionary of the Economic Plants of India," Vol. I, p. 350 :—

"The small plantation which was made last season continues to thrive. The plants are now from 4 to 6 feet high. They are remarkably healthy, and all of them are in flower.

"The genus *Atriplex* differs from that of *Chenopodium* in having the flowers unisexual, and in some species of *Atriplex* the flowers are not only unisexual, but diœcious, *i.e.*, some plants bear male flowers only, and others only female ones. The salt-bush is described in the *Flora Australiensis*, vol. v., p. 171, as diœcious. A few of the plants in this garden, are, however, distinctly monœcious,* clusters of the broad fruiting bracts being rapidly developed beneath the terminal racemes of the withered male flowers. This is so far favourable for supplying a more bountiful supply of seed for distribution from our own plants.

"Up to date 480 plants have been distributed, and about sixty are left in stock.

"Inquiries have been made regarding the condition of plants despatched from this garden to different places in India. Those sent to Cawnpore farm all died about two months after they were planted. Of the fifty plants sent to Mr. Ridley at Lucknow only two survived. These latter, he tells me, were planted out last November, and are now healthy plants, about 1 foot high, and with an equal spread. Mr. W. Impey, C.S., writing from Cawnpore in March last, says, 'The *Atriplex nummularia* plants of last year are thriving very well. Some of the bushes are 3 to 4 feet high, and I have taken many cuttings from them.' Fifty plants were sent to Bari Banki, and the president of the local committee informs me that they were planted in poor soil, where other trees and cultivation have hitherto failed. A few

* This is the case with the specimen now figured; also with other plants of the same species I have examined.

have died, and the remainder, though they have made considerable growth, are not thriving on the poorer soils, as the plant was represented to be likely to do. Mr. Dowie, the settlement officer at Kurnaul, reports favourably on the plants sent to him on the 31st December last.

"The salt-bush, being essentially a desert plant, should not be permanently transplanted until after the rainy season is over. This injunction applies more particularly to those parts of North-west India where the rains continue for any length of time. As soon as the plants have had sufficient time to establish themselves, no amount of rain is likely to injure them. If the seed is sown in pots during the hot weather, the seedling will be ready for transplanting in September or October."

Distribution.—This is the large salt-bush, which grows to a height of 10 or 15 feet, or even more. It is found between the Narran and Warrego, but hardly nearer in that direction, owing to droughts, over-stocking, and travelling sheep. It is an interior species, and no doubt at one time was found on enormous areas from, say, Moree to Wentworth. In many districts it is only represented by odd plants now. It is also found in the more arid parts of the colonies of Queensland, South Australia, and Victoria, and, as in our own Colony, it is driven further back every year.

Propagation.—One bush yields an enormous quantity of feed, and advantages of the plant are the ready way by which it may be propagated by its numerous seeds and by cuttings. The wood is exceedingly brittle, and therefore cattle readily break down a bush, but if the weather be at all favourable these pieces readily take root. Some of the lower leaves are very large, about 2½ inches across, and perhaps even more. It will stand any amount of neglect.

Reference to Plate.—The plant from which the drawings were taken is growing in the garden of Mr. W. A. B. Greaves, of "Braylesford," Bondi, who has successfully cultivated many indigenous plants. Mr. Greaves brought the seed from which this plant sprang from the Narran.

A, Portion of inflorescence, having both staminate (male) and pistillate (female) flowers, one third natural size; B, male inflorescence, natural size; C, individual male flower, magnified; D, female inflorescence, natural size; E and F, individual female flowers, magnified; G and H, fruits, with half of the fruiting perianth removed, magnified.

The Tree Tomato.

*Cyphomandra betacea, Sendtn.**

By J. H. MAIDEN
Consulting Botanist.

Vernacular names.—On the mainland of Central America it is known as the Tomato de la Paz, in Jamaica as the "Tree Tomato," and sometimes, on account of its supposed beneficial action on the liver "Vegetable Mercury." According to Dr. Masters, the fruit is occasionally seen in Covent Garden market under the erroneous name of "Grenadilla."

Botanical name.—*Cyphomandra*, from two Greek words signifying "club" and "anthers," in allusion to the club-shape the anthers assume. *Betacea*, like a "beet," referring to the general appearance of the leaves.

The tree tomato belongs to the Natural Order *Solanaceæ*, which includes the tomato, capsicum and potato, amongst edible plants.

Synonyms.—*Pionandra betacea*, Miers. *Solanum betacea*, Cavanilles.

Habitat.—The tree tomato is a native of the Andean regions of tropical America. It found its way to Jamaica, and it is to Mr. D. Morris, late Director of the Gardens and Plantations in that island, and now Assistant Director of Kew, that the credit belongs of distributing the plant throughout the world. For particulars as to its introduction into India and Ceylon I am indebted to an article in the *Kew Bulletin* for August, 1887, which also contains other interesting information in regard to this plant.

In Miers' "Illustrations of South American Plants," vol. I, page 39 (1850), the following account is given of the tree tomato, under the name of *Pionandra betacea*:—"This is doubtless the same fruit that I saw in the markets of Lima, where it is commonly used for cooking, in lieu of the ordinary tomato, the flavour of which it greatly resembles. Tweedie remarks that it is used in Buenos Ayres for the same purpose, but not ordinarily, for I never observed it. . . According to Cavanilles, this is a shrub about 4 feet in height." If this be correct as regards the size of the wild plant, it has increased largely under cultivation.

"The tree tomato was introduced to Jamaica many years ago, and it is sparingly met with on old coffee plantations, in the hills of St. Andrew and Manchester. It does not flourish in the plains; its range of elevation in Jamaica is from 2,000 feet to 5,000 feet, with a range of temperature from 72 degrees to 63 degrees F. It is found at Madeira and in the Azores, and is also cultivated in the south of Europe."

The Tree Tomato in India.—In 1882 seeds were sent to Madras for cultivation in the Nilgiris and other hilly districts of Southern India. In October, 1885, the first fruits of these plants were sent to Madras. "As Mr.

* Attributed to De Candolle in *Kew Bulletin*.

NOTE.—There is a *Cyphomandra betacea*, Miers, in Seem. Bot. Voyage, *Herald*, p. 174. It is now reduced to *C. hartwegii*, Dun., and must not be confused with Sendtn's species.

Morris, of Jamaica, stated in his letter to you in April, 1884, when he sent the seeds, it proved agreeable as chutney, fried, stewed, and in a tart, and may be useful for jam and jelly. In using the fruit the rind should be well removed, as it has a peculiar and disagreeable flavour; the pulp itself has a flavour of its own—pleasantly acid, not unlike the ordinary tomato, but more resembling the passion-fruit. The plants were grown in rather damp soil and standing close together. I removed them in September to different localities, but though full of fruit not one tree died or suffered. Flowering in May, the blossoms set well, and the fruits stood the monsoon better than I had anticipated, as only few of the fruits dropped, and some of the young trees bore over fifty. Now most of the trees show new flowers along with the ripening fruit, which may fully attain the size of a duck's egg." Later on, having noticed that an unfavourable impression had been produced at Madras respecting the growth of the plant and character of the fruit, Mr. Morris addressed the following letter to the honorary secretary of the local Agri-Horticultural Society, dated Kew, 6th July, 1886:—"I notice that in your report you do not speak very favourably of the tree tomato in Southern India. It is quite possible it may not be quite as good with you, as it undoubtedly is in the West Indies; but, on the other hand, it may be found, on larger knowledge and experience, to possess qualities which may commend it to general approval. The fruit should be allowed to fully ripen on the tree; this is an essential point as regards flavour and size. For cooking purposes all the seeds should be removed, and the outer skin. Then cut the fleshy part into quarters, and stew or cook as you would apricot or peach, or make into jam or jelly. If found too acid, steep in boiling water for a few minutes before using, and the flavour will be much milder. The planters in Jamaica attribute to it very beneficial properties as regards liver disease, and, indeed, my attention was first drawn to it under the name of 'vegetable mercury.' I cannot say anything about its medicinal properties, for I have had no opportunity to test them; but I can certainly speak highly of it as a fruit, prepared in the manner above described."

Mr. Charles Gray, of Coonoor, Madras, also writes:—"I notice in the annual report for the past year that the tree tomato is stated to have proved a failure in Madras as regards the flavour of the fruit. All I can say is that on the Nilgiris everyone that I have given a fruit to has pronounced it most delicious. . . . I write this as I for one (and there are many others here too), am decidedly in favour of its propagation, it being a valuable addition to our limited list of really tasty fruits, as well as being most ornamental."

The Tree Tomato in Ceylon.—In the report for 1884 of the Director of the Botanical Gardens, Ceylon, it is stated that "seeds have been received from Jamaica, and there are now many young plants at Hakgala." In the report for 1885, the Director says that "at Hakgala (6,000 feet), some of the tree tomato plants are now 11 feet high, and the fruits produced are very fine. They are egg-shaped, about 3 inches long, and 2 inches in diameter, and when fully ripe are of a bright yellow-red colour. They make excellent tarts, are very good stewed, and are much relished by most people when quite ripe and eaten raw, like gooseberries." In the 1886 report it is stated that the "tree tomato has spread rapidly through the hill country. The fruit keeps well after being gathered, and, as it has a tough skin and travels well, it might be largely cultivated in the villages for sale in the towns."

The Tree Tomato in Australia.—In the year 1884, Captain Murray, of the P. and O's. R.M.S. "Shannon," brought from Ceylon, in a 4-inch pot, a plant, about 4 or 5 inches high, of the tree tomato, which had been

attracting attention in Ceylon at the time. It is believed that this plant was one of the 1884 sowings by Dr. Trimen, from seed obtained from Jamaica as above mentioned, and therefore Captain Shannon's plant and the Ceylon plants were acclimatised together. The plant was presented to Mr. W. A. B. Greaves, of Bondi, and in eighteen months it fruited. In 1886 Mr. Greaves exhibited the fruit at a show of the New South Wales Agricultural Society, and was awarded a special prize for it. The newspapers and agricultural journals took the matter up, and Mr. Greaves informs me that he, in reply to requests, distributed seeds and plants in all the colonies, including the various botanic gardens. He has obtained large crops from tree tomatoes ever since 1886. Captain Shannon was also kind enough to bring a plant the following season to Mr. E. C. Merewether, also of Bondi, but I do not know to what extent plants were propagated from this. Anyhow, the tree tomato is thoroughly well acclimatised in Australia in four colonies, and no difficulty need be experienced by anyone who wants plants of it.

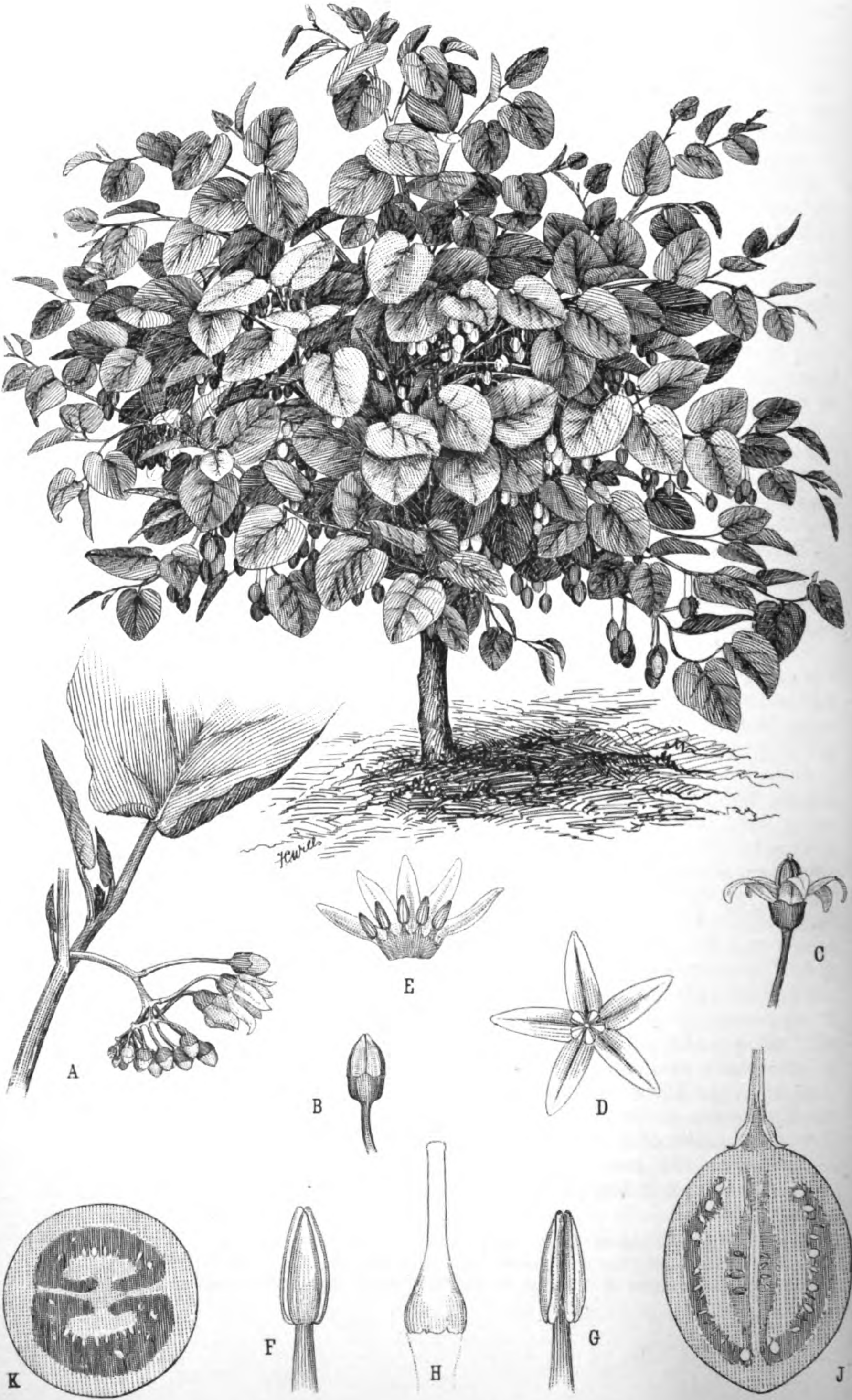
Flowers.—They are shown in the illustration, and are of a very pale purplish or rosy colour. When the tree tomato is in flower (and, in ordinary seasons, that is nine months out of the year), the flowers emit a delicious perfume, which is wafted a considerable distance. It is really sweet, and not sickly or offensive like that of a *Cestrum.* It closely resembles the perfume of *Pittosporum undulatum.* The perfume is particularly noticeable in the evening.

The Fruit.—If the fruit is allowed to fully ripen on the trees it may be eaten raw, and it has somewhat the flavour of gooseberry. If the skin is removed, and the fruit (without the seed), stewed with sugar, it resembles apricots, but with a slight sub-acid flavour, which is very refreshing.—*Kew Bulletin.*

The fruit is elliptical in section, about 3 inches long by 2 inches wide, and of a deep orange colour when fully ripe. The tree begins to bear in two years, and thenceforward, with care, it may be kept in bearing for a number of years. When once it begins to bear it yields fruit continuously for the greater part of the year.

The flavour of the tree tomato has been described by a number of people and opinions differ as to what amount of praise should be given to it. Even yet, it is new to Australians; in fact the majority of people have probably never seen it yet, much less tasted it. There is always a wide difference of opinion in regard to the palatableness of solanaceous fruits; for example, the ordinary tomato, which many people go into ecstasies over, cannot be endured by others, some of whom have tried, over and over again, to overcome their prejudice. Then again the Cape gooseberry is highly praised by some, and abhorred by others. I do not imagine that the flavour of the tree tomato will be appreciated by everybody. For my own part I like it much, but I could not eat it as often as I could apples, for instance. Mr. Greaves' family liken the flavour of the tree tomato to a mixture of pear and guava; to me it has a flavour which reminds one, amongst other things, of that of the rock melon; it, however, seems to have a flavour of its own, and hence, in trying to describe it, different people will compare it to different fruits. It may be used for dessert, but most people will prefer to make jam* of it, and it (in my opinion) makes a tasty conserve.

* Following is Mrs. Greaves' recipe for tomato jam:—Put the whole fruits into boiling water, and boil till soft. Peel off the skins and strain the pulp to remove the seed. Then, to every pound of fruit add three-quarters of a pound of sugar, and treat as for other jams.



(116 46-94)

Cyphomandra betacea, Sendtn.

My advice would be for each person to try the fruit for himself, and I suppose it will be liked by most tomato-eaters. For the first three or four years, that is, before it gets scraggy, the tree tomato is quite an ornamental small tree in the garden, its large leaves adding pleasing variety to the garden. I am of opinion that it is a very useful introduction into New South Wales, though I scarcely agree with the rapturous (perhaps interested) recommendations I have heard in regard to it.

Size.—Mr. D. Morris, in the *Kew Bulletin*, refers to the tree tomato as "a large free-growing shrub or small tree, often attaining a height of 8 to 12 feet." Mr. Greaves' plants are all at least 12 feet high, and with a very large spread. They are simply loaded with fruit. On each tree were several hundreds, and it would be perfectly impossible to count them without plucking them from the tree.

A drawback to the tree tomato is the brittleness of its wood. After a few years it gets lanky, and then, being loaded with fruit and top-heavy, it requires careful staking and shelter lest it should be broken down by the wind.

Propagation.—From seed, which is to be obtained now from any seedsman. Mr. Greaves recommends it to be grown from cuttings, as it will bear fruit the same year (in as little time as three months), and makes a more compact tree, and less liable to be blown down by the wind than seedlings. Like many other solanaceous plants cuttings strike readily.

The plant figured was grown by Mr. W. A. B. Greaves, of Bondi, near Sydney, whose share in the acclimatisation of this plant in Australia has already been narrated.

Reference to Plate.—A, flowering-twig; B, bud; C, expanded flower; D, expanded flower as seen from above, the petals straightened out; E, flower opened out; F and G, back and front view of a stamen; H, pistil; J and K, longitudinal and transverse sections of fruit.

The Dorrigo Forest Reserve.

By J. H. MAIDEN,
Consulting Botanist.

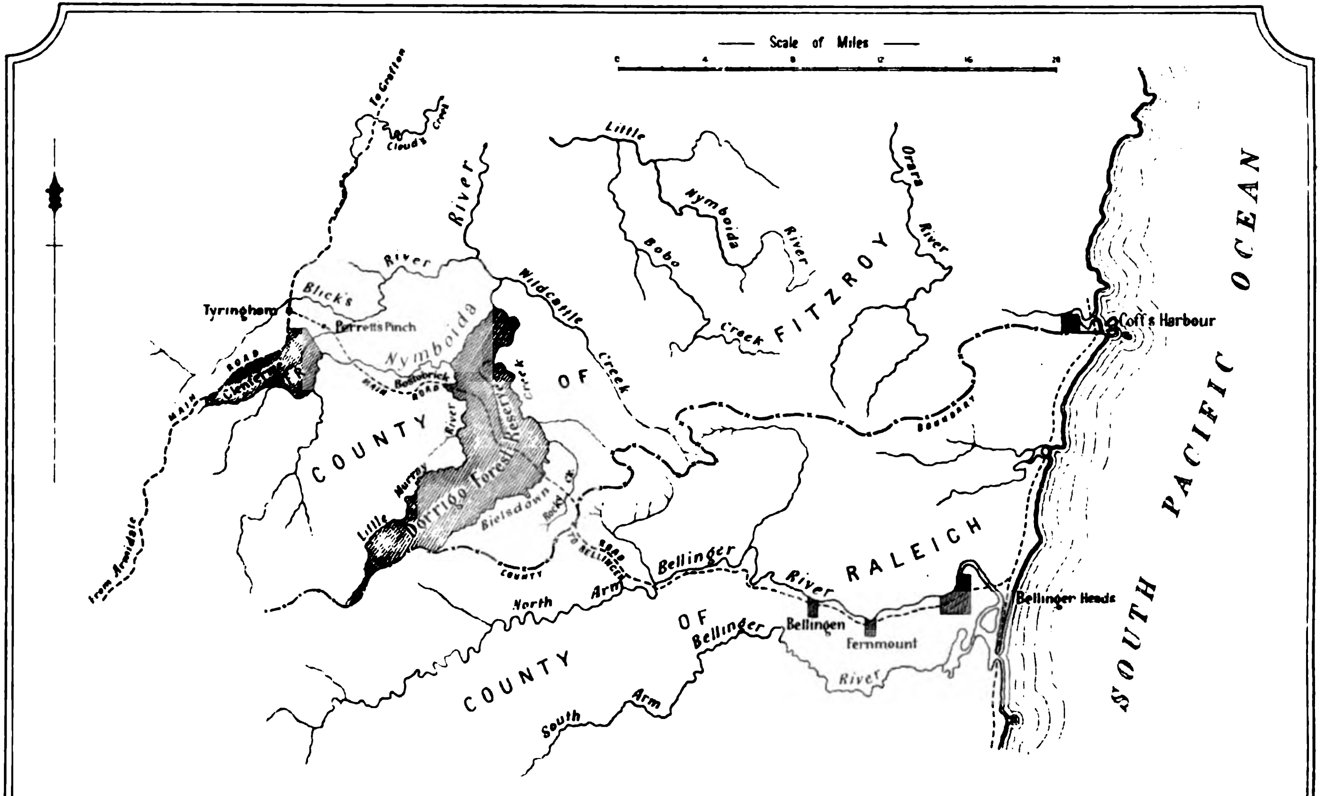
PART I.—A GENERAL ACCOUNT OF THE COUNTRY, AND HOW TO GET THERE.

THE Dorrigo Forest Reserve is situated in the county of Fitzroy. It is bounded on the south-east by Beilsdown Creek, on the south-west by the range that divides the counties of Fitzroy and Raleigh, on the north-west by the Little Murray River, and on the north-east by the Nymboi River. It embraces an area of 23,880 acres.

A locality map is given, which will indicate its position, and may be useful, since very few maps contain any reference to it. The Dorrigo is a place of more than usual interest at the present time, especially in view of the proposal to throw its rich forest lands open to agricultural settlement. It is not my intention to discuss this subject; all I propose to do is to give some idea of the country, and subsequently to give an account of the vegetation. Dorrigo, or Don Dorrigo, is said to have been so called after a Spaniard or a Mexican who first found cedar on it. Local residents are not clear whether the gentleman's name was Dorrigo or Diego, or when he made his discovery, so here is a field for the Australian archæologist.

In the Dorrigo Forest Reserve itself I spent a week under canvas in December, 1893. The season of the year is not the best for the botanist; October would be better for the flowers, and March for the fruits. Nevertheless, I made copious notes of the vegetation, and also brought large collections of dried plants to Sydney. The lists, which will be given later, are of plants which I actually observed, and will form a basis for a flora of the Dorrigo. A number of plants were neither in flower nor fruit, and where the species could not be determined with absolute certainty, it has been omitted altogether. No plant has been put down on the assumption that it will doubtless be found in the Dorrigo; I have confined myself to actual observation. The area of the forest reserve being so large, and travelling, in parts of it, so difficult, I do not submit my lists as complete, but they will be found to be far fuller than any previous lists.

Access to the Dorrigo is obtained either *viâ* the Bellinger River, or *viâ* Armidale, or *viâ* Grafton. The North Coast S.S. Company runs comfortable steamers to the Bellinger Heads, 363 miles north of Sydney, once a fortnight, calling at Port Macquarie on the way. The trip usually takes about thirty-six hours. The fare is £2, or £3 for a return ticket. Having crossed the bar, the steamer lands passengers and discharges cargo at the village known as Bellinger Heads, and an interesting drive along the right bank of the



—— Locality Map ——
Shewing Dorrigo Forest Reserve & Surroundings.

Photo-lithographed at the Govt. Printing Office,
Sydney, New South Wales.

Bellinger, first through forest country, and then amongst alluvial flats cultivated as maize farms, brings us to Fernmount (6½ miles), on a hilly situation, and commanding beautiful views of river scenery backed with hills covered with vegetation.

Soon after leaving Fernmount, the road passes over a hill (Marks' Hill). In the foreground is an extensive and well-planted vineyard (now somewhat neglected), and opening out before one is one of the most charming views of river scenery I have ever beheld. The artist will find many beauty spots on the Bellinger, and this is one of the chief of them. Regretfully leaving this "coign of vantage," we descend the somewhat steep hill, and thenceforward travel along a flat road until we come to Bellingen (10 miles from Bellinger Heads), a rising township better known under its old name of Boat Harbour. Here it is desirable to halt, for the traveller will, as a rule, find it most convenient to make a start for the Dorrigo in the cool of the morning, soon after daybreak. Leaving Bellingen (note the final "n"), there is an excellent road, following, in the main, the direction of the Bellinger River, and the eye feasts itself with views of exceptionally fine maize crops, interspersed with sweeps of river scenery. Near the road are small gullies or creeks filled to the tops of their banks with the richest vegetation, always green, and adorned throughout the year with a greater or less abundance of flowers, many of them of great beauty, those which are inconspicuous being frequently succeeded by showy or curious fruits. All around are vistas of well-wooded mountains, and we peer up at the huge mass called the Dorrigo Mountain, as our guide points out to us that part of the top of the ridge from which we shall strike out westerly.

About 10 miles after we leave Bellingen we find the Bellinger here a thin stream, though the great width of cobble stones and the traces of undermined banks very wide apart show clearly that the Bellinger at this distance from the sea is sometimes a very formidable river. We now begin a gradual ascent, and after a mile one sees a sign-post with the simple inscription "To New England,"—a reminder that we are fairly on our journey.

The ascent now begins in earnest. The old road, or rather cedar track, used to follow the ridges, and it seems almost impossible to contemplate how bullock-drays got up, and how the cedar logs (often sadly shaken and damaged), got down. The Government has recently completed a road up the mountain, which must have been a most serious undertaking, as much of it has been blasted out of a tough basaltic rock. There is just a little bit of excitement travelling up the mountain. The road is 12 feet wide, and there are some steep pinches and sharp turns in it. One side is often so steep that contemplation of it might make one feel giddy, and when one has passed a bullock-dray well loaded with cedar, one experiences, at certain bits of the road, a feeling of relief. A few days before our ascent a carrier lost some valuable horses through his cedar-dray going too near the soft edge of the bank, horses, dray, and cedar being hurled down the side of the mountain,—and with it the profits of cedar-hauling for twelve months at least. In the old days such accidents must have been far more frequent. Carriers have only had the luxury of this new road for about twelve months, and it has already caused some traffic to set in to the Bellinger, which previously could not have been thought of. It would have been a grand thing for cedar-getters on the Dorrigo Reserve years ago, but now the cedar on that reserve is practically cut out, and the last loads are being taken to market. Nevertheless, as will be seen later on, the Dorrigo contains many other valuable timber-trees, and sooner or later some of them will be regular articles of commerce. As we ascend the

mountain we have beautiful views of the valley of the Bellinger, and may see the sea far away in the distance. In the foreground is Billy McGrath's Hump, a huge mountain mass, clothed with trees to its summit.

Looking up and down the face of the Dorrigo Mountain, the vegetation is full of interest to the botanist and to other lovers of plants. As we ascended, the two showiest trees in the valley below were undoubtedly the flame-tree and the native tamarind. The former is certainly one of the most gorgeous trees in all Australia; for 80 or 100 feet in height it is a mass of bell-shaped flowers of the size of a thimble, and of a beautiful scarlet colour. The colour is not dimmed with the presence of a single leaf, for the foliage succeeds the flowers. The native tamarind is a most striking object, with its enormous bunches of orange-coloured fruit nestling in the handsome dark foliage at the tops of the trees, many of them nearly 100 feet from the ground. For the first few hundred feet of ascent we see tallow-wood, grey gum, red mahogany, a little turpentine, and other hardwoods. Passing these we find a profusion of brush-trees and shrubs up to the summit, never again seeing a gum-tree until we arrive at the "plains" in the Dorrigo. It would be mere repetition to enumerate the brush-trees seen along the mountain, but they are full of interest. One of the features of the vegetation is the great number of *Solanums* of varying size. The flowering shrubs are plentiful, interesting, and many of them beautiful.

Such is a cursory account of the vegetation one meets on one's way to the Dorrigo. Fuller details must be looked for in the list of plants which will be given.

Ascending the mountain, and contemplating the views at my feet and towards the ocean, I saw much to remind me of the views from the Bulli Mountain and the Sugarloaf Mountain, near Braidwood. The Dorrigo Mountain is bigger, and the views are on a grander scale than the Bulli. The Sugarloaf Mountain is beautiful, and I do not know how that scale of beauty is graduated which would enable one to put any other mountain scenery of the same character higher in the scale; but I am paying the Dorrigo Mountain what I intend to be a great compliment when I say that it is not inferior in beauty to the better-known Sugarloaf Mountain. I trust that some of our travellers, who seek in other colonies and in distant lands fresh scenes of natural beauty, will bear in mind the attractions of a trip up the Dorrigo Mountain, which may now be ascended and descended from Bellingen within the space of a long day.

When we are fairly on the top of the mountain (2,900 feet), after a journey of about a mile through rich chocolate soil, we cross Rocky Creek, and on the banks of it I saw for the first time the true beech of New South Wales (*Fagus Moorei*), of which I had heard so much,—a large tree, with dark, handsome foliage, of which I must have literally seen millions between here and Bald Hills Station (its most western locality), 65 miles from Armidale. We saw a few poor specimens of colonial pine (*Araucaria Cunninghamii*), coming up the mountain, but in the country past Rocky Creek, there are many fine trees, which are not at present utilised. The Bellinger is the most southerly locality for this species. Pursuing our journey, the country right and left of the road consists of almost impenetrable scrub, containing pine, coachwood, rosewood, sassafras, ironwood, and a host of less-known timbers, while the graceful little walking-stick palm (*Kentia monostachya*), is tolerably abundant, and locomotion in the scrub is rendered difficult by the prickly clothes-line stems of the Lawyer palm (*Calamus australis*) and the prickly *Rhipogonums*. Fine *Todeas* and various tree ferns are plentiful, as are handsome flowering shrubs on the skirts of the brush land.

After 2 or 3 miles of this road, we suddenly enter one of the "plains" or meadows, and are fairly in the Dorrigo.

The Dorrigo Forest Reserve consists for the most part of brush land, containing a great variety of timbers. In various parts are plains, which simply consist of grass-land, usually entirely destitute of trees, except a few specimen trees dotted about as in a gentleman's park. Usually the edge of the scrub and of the plain are as sharply defined as it is possible for them to be, as though a Brobdingnagian with mighty sickle, had there finished his reaping. The country is not by any means flat; it is usually undulating, and sometimes hilly. On the greater part of it, it would be difficult to find an area suitable and sufficient for a cricket match. In the forest itself there is almost perpetual gloom. The trees are so close together, are so tall, and have such leafy tops, that unless one keeps in beaten tracks, along which the timber has usually been felled, one rarely sees the sky, except an occasional glimpse obtained at the expense of a crick in the neck. There are many tracks in the forest, but most of them lead to cedar-pits, and a stranger to such country might pass from track to track for an indefinite period, and readily get bushed. To the untrained eye there seems but little diversity in the forest vegetation, and this would add to the difficulties of a stranger.

The arboreal vegetation of the Dorrigo consists entirely of what are known as "brush" timbers. Not a single species of Eucalyptus is found in it, though on the skirts of it (never penetrating beyond the fringe), is one solitary species of gum-tree, a white gum (*Eucalyptus viminalis*). To specify all the timbers of the Dorrigo would be far too tedious, but I may mention cedar, rosewood, tulip, ironwood, hoop pine, negro-head beech (*Fagus*), one of the silky oaks (*Orites*), sassafras, corkwood, marblewood, maiden's blush, and black apple. On the trunks of many of the trees, and particularly on the moisture loving *Fagus*, are innumerable individuals of orchids, ferns, and mosses, but I was disappointed to find that they consist of fewer species than I had expected. The charming Aroideaceous plant (*Pothos Loureiri*), is quite a feature in parts of the reserve, encircling most of the trees with graceful leafy girdles.

If scenery be desired, on the Dorrigo we have many choice spots. Near the south-eastern boundary of the reserve, the Beilsdown Creek, a considerable brook, and even a small river at times, throws itself over a ledge of rock some 60 feet high, forming a beautiful waterfall, known as the Beilsdown Falls. The water has excavated a deep basin, and the banks of the creek at this part form a deep gorge, while round the basin, and skirting the gorge, are ferns innumerable, the whole forming a very pleasing view. Another creek (Boggy Creek) no great distance away, also has a pretty waterfall, embowered with shady trees. The views of undulating country near Coghlan's, backed with well-wooded hills, are, in my opinion, simply charming, while the landscape, as one emerges from the dense forest, and looks towards the Little Murray River, with the Bald Hills in the distance, is so beautiful that I commend it to the attention of those of our artists who love to depict Australian scenes. This magnificent view gives me pleasure every time I view it with my mind's eye, and visitors to the Dorrigo could be promised other lovely scenes, though I cannot think of any finer than this.

According to all accounts, the Dorrigo is favoured with a singularly delicious climate. My visit was in December, but, while it was hot in the middle of the day, it got chilly at sundown, and one was always glad of a blanket at night. There is abundance of good water in the creeks, which I

am told are never dry. No observations have been taken in regard to the rainfall, which is, I should imagine, pretty considerable. On the adjacent coast there is much rain, Mr. Russell's report for Fernmount giving 98·69 inches as the mean annual rainfall, and the average number of rainy days in the year as 134. Records have been taken for three years only.

The Dorrigo is, without doubt, the sanatorium of the Bellinger Valley. Whatever the extent of the development of its agricultural and forest resources in the future, there is no doubt it is destined to become important to furnish cool, salubrious residential sites for jaded, anæmic dwellers in the heated valleys and coast lands. In the "plain" lands in the Dorrigo there are very many charming sites, either on land entirely denuded of timber, or possessing but a few trees, scattered here and there.

When we left the Bellinger for the wilds of the Dorrigo we could not truthfully say that we had not been solemnly cautioned in regard to the perils we were about to encounter from ticks, snakes, or leeches, or all three. But I do think the Dorrigo has been shockingly maligned. My duties took me into the most snaky-looking country, and I constantly had to fight my way amongst shrubs which are here and elsewhere always pronounced to be full of ticks, and I certainly had to go wherever leeches are most expected. But after a week in the Dorrigo brush (*vulgo* scrub), and two days in the Glenfernie brush, which strongly resembles it, my companion saw one solitary snake, known locally as "Bandy-bandy." This is the common ringed snake (*Vermicella annulata*); it is venomous, but has a mouth so small that it is only dangerous to insects. I afterwards saw an unfortunate black snake which had been run over by a bullock-dray—two snakes in all—a miserable record compared with what I have seen in parts of the Blue Mountains, for example. As to ticks, I would deny their existence in the Dorrigo, if certain people I know to be trustworthy, had not assured me that there are some. In any case I am afraid their number has been exaggerated, as is often the case in regard to statements concerning unfrequented country. With regard to leeches, I saw several specimens of a small species, but not a single horse-leech, a very different record to the country at the foot of the Bulli Mountain, for instance. In my tent I caught two mosquitoes, which had probably come up with my baggage. While I do not wish to generalise from my own limited experience, I may express the opinion that the Dorrigo is unusually free from animal pests.

The visitor who desires to get to the Dorrigo from Armidale, will find clean and comfortable country hotels at Wollomombi (28 miles), Guy Fawkes (50 miles) in the Snowy Range, and an hotel (Perrett's) at Tyringham (78 miles). So far we have been journeying along the main Armidale-Grafton Road, a very good road for the greater part, but at Perrett's we branch off. From the hotel we, for a mile or two, travel along a road as easy as that of a park drive, and then we come to a notorious bit of road known as Perrett's Pinch. The road for a few hundred yards is here simply the side of a rather steep hill, and every traveller is glad when he is over it. From thence the route, *via* Bostobrick, is mostly through rotten granite, and deep ruts and fairly steep pinches are common. Four miles from Perrett's we cross the Nymboid, which is often a formidable stream; 2 miles further on we leave Bostobrick head station on our left; and after 6 miles more we come to the Little Murray River, crossing which we are in the Dorrigo Forest Reserve. After a pleasant ride of a mile and a half through an undulating "plain" we enter the forest at the spot which I have above indicated as affording a lovely *coup*

d'oeil. There is no made road from Tyringham to the Dorrigo, and travellers must expect to rough it. The distance is, however, as has already been indicated, only about 16 miles.

The Glenfernie Forest Reserve is about 20 miles north-west of the Dorrigo by road, and about 3 miles from Tyringham. Being so handy to the Armidale-Grafton Road, the cedar in it has been cut out long since, but it contains a good deal of Colonial or Hoop Pine (*Araucaria*), and there is a mill which is almost exclusively devoted to cutting pine from this reserve. This, I believe, is the most southerly mill in which this well-known pine is cut for commercial purposes.

The Dorrigo may also be reached from the Clarence, start being made from Grafton, along the Grafton-Armidale Road. The road is *viâ* Nymboida and Cloud's Creek, and after crossing Blick's River, one comes to Perrett's (Tyringham), and then branches off along the same road which would be traversed by a traveller from Armidale to the Dorrigo. The distance from Grafton to Perrett's is about 75 miles. The disadvantage of the Grafton route is its greater length, especially in view of the new road up the Dorrigo Mountain. The chief drawback to the Bellinger route is the uncertainty of the bar. Grafton is the metropolis of these parts, and my only regret is that I could not approach the Dorrigo both by the Bellinger and the Clarence.

In my next article I hope to give an account of the plants I found on the Dorrigo and adjacent country, laying stress upon such as are of economic value.

Botanical Notes.

By J. H. MAIDEN.

A Native Timber Suitable for Tobacco-pipes.

It has long been known that the timber of a small tree which grows in th arid interior is suitable for tobacco pipes. The botanical name of this tree *Hakea leucoptera*, R.Br., and it belongs to the natural order Proteaceæ, whic includes honeysuckles (*Banksias*), *Grevilleas*, and such plants. It aboriginal name is "Ury," and because of the prickly nature of its leaves, goes under the name of "pin-bush" and "needle-bush." Because goo drinking water used to be obtained by the blacks by chopping its fleshy root into short lengths, and standing them on end, it is known as the "water tree," though it is by no means the only tree whose roots are employed fo this purpose. Because of the colour and general texture of the wood it known as "beef-wood," being one of many colonial timbers which posses that appellation. In appearance the timber resembles that of a number o *Banksias* and *Hakeas* throughout the Colony. The appearance is not eas to describe, but timbers of the *Proteaceæ* have a figure which is all thei own, and which, when once understood, can never be confused with an other group of timbers.

Mr. Forester Kidston, of Hillston, in whose district a good deal of thi western beef-wood grows, was asked to report upon it, and his interestin statement is best given in his own words:—"I have seen no place where large quantity of it could be got within a small area, but it is very generall distributed over the timbered parts of my district. It is to be found in con siderable quantities on Melrose and The Overflow Stations, also on Eremeran Booberoi, Huabba, and Uranaway Runs. The latter is in the county o Blaxland. It is the root which has been used for making pipes, so far as m experience goes. Being a smoker, I can say confidently that it surpasse cherry, briar, or any other pipe I have seen. It is at best only a large bush and only attains a maximum of 9 inches in diameter."

Many a smoker in the Lachlan country regards, with feeling akin to pity people in other parts of the Colony where the beef-wood does *not* grow. Th local manufacture of home-made tobacco-pipes must be great, and I have o several occasions been shown beef-wood tobacco-pipes which it was hard t realise had been made in the bush, and with rough tools. I understand tha in Sydney at least one firm is engaged in the manufacture of pipes from thi wood, so I hope that Australians who love a pipe will consider the expedi ency of giving this highly-recommended wood a trial. The wood has bee extolled to me so often and so long, and by men whom I take to be judge of a pipe, that those who try it will probably be pleased with it. And now a-days we must look after these little products and little manufactures Great ironbark girders, huge turpentine piles, box decking, and so on, ar

all very well, but in contemplation of the magnitude of the industries connected with our hard-woods, we must not neglect the small woods for special manufactures.

Tobacco-pipes are in various countries made of various materials, as fancy or necessity dictates, but in Europe two kinds of wood are of course most appreciated by connoisseurs, viz., the cherry and the briar (*Erica arborea*, Linn.), a corruption of the French Bruyére, or tree-heath, belonging to the Ericeæ, or true Heath family. Of this small tree the root is used for pipe-making, and enormous quantities are worked up in Tuscany (Italy), in Vienna, and other places. Of the beef-wood, I have seen pipes made of both the root-stock and the trunk. The former is probably the best, but to what extent, only smokers can say.

Noxious Weeds.

It is the intention of the Botanist to deal systematically and thoroughly with the important question of eradicating noxious weeds. In order to do this satisfactorily it is absolutely necessary to obtain authentic and wide information. For this purpose a few questions are appended, in the answering of which the Department feels confident of the cordial and prompt co-operation of pastoralists, agriculturists, and all others who take an interest in land matters, and that fresh samples combining flowers and fruit (seeds) will be forwarded with a view to having accurate illustrations prepared for publication in the *Gazette* in connection with the descriptive matter and recommendations which it is proposed to offer regarding them.

Following are the questions:—

(1.) What are the worst weeds in your district? Write them in order of obnoxiousness (send fresh samples of each).
(2.) State the bad points of the six worst at least.
(3.) Can you say when any of these weeds first made their appearance, and how?
(4.) What are the situations they most frequent? Are they spreading much, either in cultivated or uncultivated land?
(5.) Have any, and, if so, what, steps been taken for keeping them under control or eradicating them?

Name,
Address,
Occupation,

The Jerusalem Cherry.

Specimens of the fruit and leaves of a plant sent to the Department for identification, and to ascertain if the fruits are poisonous, have been identified by the Botanist as *Solanum pseudocapsicum*, Linn., commonly known as the Jerusalem Cherry. "The fruits are reputed poisonous," says Mr. Maiden, "but I cannot ascertain any case of poisoning by them. They are so very common in Sydney gardens that, if they are really dangerous, it seems reasonable that one should be able to definitely prove their poisonous nature. I have had a shrub in my garden for years, and various people warned me to root it up on account of my little children. I have invariably asked them their grounds for saying it is poisonous, but the reply has always been, 'I have always thought it was poisonous.'" Should any of our readers be able to give authentic information on this point, it will be gladly welcomed and published.

Phylloxera-resisting Vines.

By J. A. DESPEISSIS,
Consulting Viticulturist.

The wild American grape-vines comprise several tribes and numerous varieties, which have for the past twenty years been extensively experimented with, especially in France, in relation to their suitability as phylloxera-resisting stocks for the purposes of grafting the choicer varieties of European grape-vines.

As the result of extensive experiments, the few varieties of vines reviewed below have been found to answer the requirements of the several surrounding conditions met with in European vine-growing districts, and I would beg to recommend that seeds from these varieties be introduced from the most reliable sources available; and, although it is claimed phylloxera is not propagated through the medium of grape seeds, that on arrival, and to make assurance doubly certain, they should be carefully disinfected by the departmental officers by means of carbon-bisulphide fumes, and sown for subsequent propagation and distribution at the Department of Forestry's nurseries at Gosford, and also at the farm at Wagga Wagga.

Perfect authenticity of the seeds, and utmost precautions against any possibility of introduction of the phylloxera even through the seeds, would, in my opinion, be insured by requesting Mr. G. Foex, the Director of the Ecole Nationale d'Agriculture of Montpellier, France, to collect and forward to the Department, parcels of, say, 10 lb. each, of the best sub-varieties of *Vitis riparia*, *V. rupestris*, *Solonis*, *York's Madeira*, and *V. berlandieri*.

Vitis riparia.—By general consent, the palm is awarded to this vine, as a phylloxera-resisting stock, that combines all the requisites. The wide area of its geographical distributions in North America has, however, created local peculiarities of growth, which explain why it is that some individual importations from America are in greater favour than others.

The *V. riparia* (sp. *Fabre*) is considered one of the best of the sort.

Its chief points are:—The cuttings strike easily; they take the graft well. Numerous observations have demonstrated the fact that in the European vineyards which have been reconstituted by using it as stock vines, the time of bearing is singularly shortened, while the yield is more abundant than in the case of vines of similar varieties growing on their own roots. Its only shortcoming is that, in the case of some sub-varieties, the stock is sometimes more slender in growth than the vine it supports. In purely calcareous soils, like those of the Cognac district, for instance, some other variety, as, for instance, the *Vitis berlandieri*, should be substituted for it, as it is affected by a form of *chlorosis* caused by deficient nourishment.

It requires a soil fairly well balanced in the various elements of plant-food, and in this respect will be found a great favourite in most of the Australian vine-yards.

The *Solonis*, believed to be a cross between *V. riparia*, *V. rupestris*, and *V. candicans*.—To its first two parents it owes its immunity to the attacks of phylloxera, and to the last its remarkable aptitude for thriving in wet and marshy soils where most other stocks would die. Well adapted for heavy, clayey, and wet soils. From its last parent it derives a certain degree of susceptibleness to anthracnose or black spot, and must receive suitable treatment for that disease.

A most resisting stock for soils impregnated with saline substances.

The cuttings do not strike so easily as those of *V. riparia*.

York's Madeira.—Like the well-known Isabella, a cross of *V. labrusca*, but unlike that grape-vine well known all through Australia, one of the most phylloxera-resisting vines known; may be said to be, as regards its habits of growth, an *anti-solonis*, in so far as it is much in demand for dry, rubbly soils, where *riparia* would thrive poorly. It grows, however, proportionately better in the richer classes of soil.

The cuttings strike well, but the vine is a slow grower, although once established and grafted it ensures regular and heavy crops of grapes for a very long period of time.

V. rupestris.—Like the York's Madeira, and although not claiming any close botanical relationship with it, is much sought after for poor, barren, and rocky soils; does well in sandy soils especially; hence its American appellations of sand's grape; thrives where *riparia* would starve. Like the York's Madeira, too, it is characterised by the slowness, but also by the regularity and completeness of its development. Rose varieties possessing the widest leaves are found the best.

V. berlandieri.—This variety, lately introduced from America, is proving the saviour of vinegrowers on the calcareous soils of the Cognac district, where hitherto every phylloxera-resisting stocks tried had succumbed to chlorosis.

I would caution intending vinegrowers against the use as phylloxera-resisting stocks of the Isabella and of the *V. californica*, as I am aware the name of these vines are wrongly associated in these colonies with those of phylloxera-resisting American vines, which would prove, if tried by them, a complete delusion.

V. californica is reported as a failure in the attempt at reconstituting phylloxera-stricken vineyards. It has been cultivated for a period of over ten years at the Agricultural School of Montpellier, where it was grown from seeds sent by Mr. Wetmore, of San Francisco; it has always shown poor growth; is very susceptible to the attacks of phylloxera and to those of fungoid diseases, such as the mildew, &c. It is also almost impossible to grow it from cuttings, as I have myself tested it last year at Rocky Mount, not a single one of those I put in having grown.

As vinegrowers must, in a great many cases, adopt such stock as are suited for their particular soil, it would be important for them to know which are those most suited, and I here transcribe the results of interesting observations quoted by Mr. H. Marès in his report on the questions submitted to the Minister for Agriculture in France for the year 1888:—

The table shows the influence of good and of indifferent stocks on the yield of the same variety of grapes (*Aramon*, 8 years old), all grown under

similar conditions. The observations extended over a period of five years, and the results are given in kilogrammes for one stock of vine.

Roots free from Phylloxera.

	Sub-variety.				
Riparia ...	Despallières	(good)	...	22 kilos, 750 grammes	Shows the influence of good or indifferent stocks of the same variety.
	De Las Sorrès	„	...	21 „ 670 „	
	Brazille	(bad)	...	10 „ 620 „	
Solonis ...	...	...	...	22 „ 366 „	
Berlandieri	...	...	...	20 „ 150 „	
York's Madeira ...	...	...	...	17 „ 607 „	

Roots showing Signs of Phylloxera.

Tarques	14 kilos, 681 grammes.
Cunningham	9 „ 977 „
Taylor	9 „ 800 „
Franklin	8 „ 781 „
Clinton	8 „ 324 „
Alvez	7 „ 932 „
Elvira	4 „ 903 „
Black July	4 „ 415 „
Rulander	2 „ 376 „
Clinton Violla	1 „ 800 „

Particulars of the steps taken by the Department in this connection will be found in "General Notes," at the end of this Part.

Wood Pavements in Sydney, 1880-1893.

Town Hall, Sydney, 31 October, 1893.

To The Under Secretary, Department of Mines and Agriculture,
"Forests."

Sir,—In compliance with your letter of 16th October inst., requesting me to compile a paper on the question of wood-paving, in order that the copies may be printed for distribution, I have the honour to submit the following for your information.

The first wood pavement in Sydney was opened for traffic in August, 1880; the section treated was that portion of King-street between George and Pitt Streets, and was simply an experiment to prove which class of timbers was the most effective.

First Method.

Before going deeply into these effects it is necessary to describe the methods that were employed in laying the foundation of concrete and thereupon the blocks, and perhaps the shortest course will be to quote from the specification the methods of execution, as follow:—

Laying Concrete Foundation.—The ground to be first well watered; on this lay a layer of wet broken stone, consisting of such of the old macadam as may be suitable, any further material to be of approved hard-stone broken to a two (2) inch gauge provided by the contractors; then spread a layer of cement mortar with a spade, and on the mortar a second layer of wet broken stone; beat this upper layer into the lower layer with beaters like large spades (made with one quarter (¼) inch sheet-iron about twelve (12) inches square, with straight handles). Another stratum of mortar, followed by a third of stone is then laid and the beating process continued, and so on until the required thickness of six (6) inches is attained. Then the surface is first beaten and finished by rubbing with the beaters to the proper convexity shown, the same being left quite smooth and regular. The mortar is to be composed of three (3) parts by measure of good clean river gravel, or approved stone chippings, to one part of best Portland cement. The entire proportion of the concrete when completed to be at the rate of four (4) parts of broken stone to three (3) parts of gravel and one (1) part of cement. When finished seven (7) days are to be allowed to enable the concrete to set thoroughly, and it must be inspected and approved before the blocks are set in the work.

Laying Blocks—Joints for Hardwood and Softwood Blocks.—These are then to be laid in rows transversely across the street on the concrete with the ends of blocks butting close, each row of blocks to be laid straight and regular to the proper convexity of the roadway, and to be spaced apart by

strips of well-seasoned and durable wood two (2) inches deep and one (1) inch thick in the case of hardwood blocks, and one and a half ($1\frac{1}{2}$) inches thick where softwood blocks are used.

Grouting.—When a sufficient area is paved the space between the rows is to be grouted to a height of two and a half ($2\frac{1}{2}$) inches above strips, with a mixture of clean, sharp, dry sand and tar, boiled sufficiently to abstract the light oils; this mixture to be made so that it will just run and make a thoroughly solid joint. The remaining one and a half ($1\frac{1}{2}$) inches to be flushed up to the surface of the blocks with cement grout, composed of best Portland cement, mixed with an equal quantity of clean sharp sand and fine gravel.

Finished Surface of Roadway.—When the grouting has set, the whole surface of the roadway is to be covered with a layer of clean coarse sand spread to a thickness of three-fourths ($\frac{3}{4}$) of an inch, and the traffic permitted to run over it.

Each Kind of Wood Separated.—The blocks will be supplied by the Corporation, and will be of various descriptions of timber. The contractor will be required to keep each kind of timber distinct, and lay them in separate lengths along the street, as will be directed. All the blocks are required to be of thoroughly sound well-grown timber of their various kinds, to be cut from the heart of the tree, and to be well seasoned and free from sap. Before being laid in the work the blocks and spacing-strips are to be steeped in boiling tar for the space of twenty-four (24) hours.

These extracts from specification, dated 8th August, 1880, are sufficient for description of wood pavements as then laid.

Timbers Used.—The timbers used in the work were of the classes known as red-gum, blackbutt, ash, box, baltic, blue-gum, brown pine, and cedar.

Removals and Renewals.—In January, 1885, about one-sixth ($\frac{1}{6}$) of the ash timbers were removed add renewed with spotted-gum and blackbutt. About one-tenth ($\frac{1}{10}$) of box, one-half ($\frac{1}{2}$) of baltic, one-quarter ($\frac{1}{4}$) of brown-pine, and all the cedar blocks were removed, and blocks of blue-gum laid. The remaining timbers were left in the work, and regarded as in fairly good condition. At the time of writing all the old blocks have been removed and the paving relaid with blocks of blackbutt and tallow-wood.

Wear of Different Woods.—The different timbers having worn as follows:—

Blue-gum	$\frac{1}{10}$ of an inch per annum.		
Mahogany	$\frac{1}{8}$	"	"	
Turpentine	$\frac{1}{17}$	"	"	
Brush-box	$\frac{1}{7}$	"	"	
Spotted gum	$\frac{1}{7}$	"	"	
Baltic	$\frac{1}{10}$	"	"	
Colonial cedar	$\frac{1}{12}$	"	"	
Blackbutt...	$\frac{1}{26}$	"	"	
Colonial pine	$\frac{1}{22}$	"	"	
Blue-gum...	$\frac{1}{12}$	"	" (about)	
Red-gum	$\frac{1}{10}$	"	"	

Spruce.—A few blocks of spruce were laid in King-street, and wore about one and a quarter ($1\frac{1}{4}$) inches, buckled and warped to an unshapely form and split to destruction. This timber is very light, evidently not suited for wood-paving, and the City Council has discontinued its use beyond that laid in the first pavement in the city.

Spotted Gum.—The wearing surfaces of the blocks of spotted gum from King-street were thickly impregnated with gravel and extraneous matter, causing an irregularity of surface, the sides of the block in section showing a quick intention to split, the top edges of wearing surfaces were frayed over on each side for about one quarter (¼) of an inch in plan and section. Spotted gum is a treacherous timber to deal with, inasmuch that if the tree is not fully matured the blocks therefrom, painted with tar, laid in the work, enclosed air-tight, sap is prevented from escaping, and its fermentation sets up "dry rot." This has occurred in many instances, and as one block is attacked dry rot spreads throughout those adjacent. A sample block showing this decay is forwarded herewith.

Turpentine.—The block of turpentine wore uniformly, the wearing surfaces were uninjured, and the block otherwise sound.

Brush-box.—The brush-box did not show itself to be a sound timber for the purpose of wood-paving. The grain indicated a likelihood of warping and buckling. The condition of timber may be written as good for its class.

Length.—Another block of this timber, laid with close joints, examined after twenty (20) months' wear, showed a contraction of one-eighth (⅛th) of an inch in its length, and wore at the rate of one thirty-third ($\frac{1}{33}$rd) of an inch per annum. (Sample block forwarded.)

Colonial Cedar.—Colonial cedar presented a spongy-wearing surface for a depth of one-eighth (⅛th) of an inch. The block was perfectly sound.

Black Butt.—Black butt has worn evenly and regularly, and did not approach a sign of decay.

Colonial Pine.—Colonial pine had in several cases split obliquely across section following the grain.

Red Gum.—The upper surface of red gum was but little affected by traffic, except that jarring caused the edges to burr and overlap. The block was well preserved.

Blue Gum.—Blue gum showed a uniform wear similarly frayed at the edges, otherwise sound and not affected.

Mahogany.—A few blocks of mahogany indicated a thoroughly-good timber, even in wide-jointed pavements. The blocks maintained original shape.

Relaying old Blocks, 1-inch Joints.—For a time the works were under similar methods, and recently experiments have been made by taking up the old wide-jointed pavements and relaying blocks hammered up close on a cushion of tarred screenings and dust, flushing the joints with boiling tar and hot sand. The pavement so formed has been heavily and quickly travelled upon for about eight (8) months, and so far the result is good. The blocks so relaid had worn from half (½) an inch to two (2) inches. The cost of the work was about three (3) shillings per yard.

Reduced width of Joints.—Upon these facts the City Council considered it wise to reduce the widths of the joints as circumstances and conditions would admit, and accordingly I prepared a specification in which it is optional to lay the work either with close or one-quarter (¼) inch joints. Feeling satisfied that if wood pavements were laid in accordance therewith, I quote extracts (more particularly referring to the methods of preparing the foundation and laying the blocks) as part of this report:—

Foundation—No. 1 Concrete.—"1st. River gravel and coarse clean sharp river sand in suitable and approved proportions, the aggregate being mixed at least twice dry and twice wet, before being put into barrows. The gravel not to be larger than two and a half (2½) gauge, large pebbles to be discarded or else broken smaller. The concrete to consist of one (1) cask of cement

to twenty-four (24) cubic feet by measure of gravel and sand as shall be directed; or,

No. 2 *Concrete.*—"2nd. The aggregate may be composed of blue stone, free from all dirt and other materials, mixed with the dust and screenings obtained from crushings in the following proportions:—To one (1) cask of cement mix twenty (20) cubic feet of blue stone, broken from one (1) inch to two and a half ($2\frac{1}{2}$) inch gauge, and add fifteen (15) cubic feet of fine blue stone screenings and dust, composed of equal quantities of screenings not more than five-sixteenths ($\frac{5}{16}$ths) of an inch gauge, and dust obtained from the blue stone crushings. No foreign material to be introduced, and the whole of the stone screenings and dust to be perfectly clean and approved before use. The concrete to be prepared and mixed precisely similar to what has been previously specified for in No. 1 aggregate. The concrete is to be incorporated with not too much water, spread, and well consolidated by ramming to a total thickness of six (6) inches to the convexity indicated on drawing, varying as circumstances may require from 1 in 40 to 1 in 80. The concrete is worked up to a fine smooth surface and to the true convexity and the levels, so as to enable the floating, to be as thin as possible, and to form a homogeneous mass with the body of the concrete.

Floating.—"The top is to be finished off with a thin floating or rendering of fine stuff consisting of two (2) parts of coarse clean river sand free from all river gravel to one (1) part of cement, so as to bring the concrete to a perfectly smooth and uniform surface to receive the blocks, and finished off to a proper level and convexity; floating to be gauged with not more than thirteen (13) per cent. of water spread when and how directed. The work of laying the concrete and floating is carried on as speedily as possible, so as to render the entire mass compact. When finished at least seven (7) days elapse, so that the concrete will be thoroughly set. During this period the floating is, if required, kept moist and protected by means of damp sand or bags spread over its entire surface, to prevent its becoming dry or damaged by the heat of the sun. When this work is completed and approved the paving is carried forward with vigour."

Expansion Joint.—"A puddle of clean clay, two (2) inches in thickness, and to the full depth of the blocks, is placed between the kerbs and the wood-paving throughout the whole extent of contract." This allows for expansion that may follow rain and climatic changes.

Deep Kerbing.—This expansion joint is necessary, because when the blocks swell the kerbing and flagging are likely to be displaced. The City Council, to further remove this action, has increased the depth of the kerbing from twelve (12) to eighteen (18) inches, thus the block is pressing, as it were, against the middle third depth of the kerbing, and it is not probable that a displacement will follow; rather, however, that the joint will be forced up.

Size of Blocks.—"The entire area of the street is paved with wood blocks cut true and square in exact lengths of six (6) inches and thickness of about three (3) inches, and varying in width from six to nine (6 to 9) inches, which limit must not be exceeded except in the case of closures, when smaller blocks may sometimes be necessary." The blocks are laid on the concrete foundation three rows longitudinally against the kerbs throughout. The remainder of the blocks transversely or diagonally across the street to form an angle between thirty (30) degrees and forty-five (45) degrees or as otherwise directed to the convexity shown, the ends of blocks abutting against rows parallel to kerb to be neatly cut so as to form a close and even joint.

Quarter-inch Joints.—In laying a pavement with one-quarter (¼) inch joints the blocks are separated by bare quarter (¼) inch battens, that, upon completion, joints will not be of greater width than one-quarter (¼) of an inch.

Smooth Surface.—The joints are, so far as practicable, perfectly regular and uniform, and the blocks laid so as to form a smooth and regular surface.

Rows to break Joint.—Each row breaks joint not less than two (2) inches with half blocks properly sawn (not split) closing against longitudinal rows, the spaces between the rows to be regulated by means of planed batten strips bare one-quarter (¼) of an inch thick, to be drawn as each space is grouted, every care is taken to prevent the regular distances of the rows being altered whilst ramming.

Depth of Gutters.—The depth of gutters is regulated by circumstances, generally 6 inches below the top of the kerb, except where a change is advisable at intersections and other places to ensure proper surface drainage.

Diagonal Pavements at Intersections.—At intersections of streets or otherwise the blocks are sometimes laid diagonally, as before described. In such places where the blocks require it, they are neatly sawn so as to mitre closely at angles, and in all such cases meeting faces of blocks are well tarred or coated with wood-preserving oil.

Close Joints plugged up.—In pavements with close joints the blocks are dipped in or painted with boiling pitch and tar mixed in proper proportions and plugged up as close as possible.

Top-dressing.—The top-dressing consists of tarred pea gravel (free from dust), hard and not easily crushed. To gravel is added sufficient sand, prepared as for grouting, to cause it to bind and form a firm surface for the pavement.

Grouting.—In grouting the blocks are firmly fixed in position by pouring in coal-tar pitch mixed with fine grit to a depth of at least one (1) inch above the bottom of the blocks. The coal-tar pitch is melted in suitable cauldrons to just such a consistency that will cause it to set when cold as "medium pitch." When this is set the remainder of the joint is flushed up level with the surface of the blocks, with a grouting of tar, pitch, and clean, coarse, sharp, river sand (pea gravel of approved size is not objected to), mixed in such proportions as will admit of the agglomeration firmly setting within the joints.

Tar and Pitch boiled.—The tar and pitch is mixed well boiled, added to thoroughly heated and dry sand. The sand (and gravel if any be used) is heated in suitable warming pans.

Grouting Caulked.—The grouting is rammed and crammed into the joints until it is thoroughly solid for the whole depth of the blocks, thoroughly caulked with proper irons, and finished off with smoothing irons. On completion of the grouting the travelling surface receives a thorough coating of well-boiled tar sprinkled with coarse sharp river sand and pea gravel, or else fine blue stone screenings and tar. Where the paving is laid with butt joints it is similarly treated before the pea gravel is spread.

Joints Water-tight.—The tar and sand is well swept into all the interstices and sides and ends of the blocks so that the joints are rendered thoroughly water-tight.

Paint or Dip Blocks.—Ends or butt joints of blocks, as also the sides and bottoms, to receive a coating of tar laid on hot, either by dipping or by well painting with a brush, otherwise coated with wood-preserving oil. In my report upon city works carried out during 1892 I have gone carefully into

the wear of different classes of timber, laid in one or other of the modes hereinbefore described, and I have stated that:—

Wood-paving.—"The paving with butt joints is very satisfactory, and justifies the extension of the method in present and future contracts, provided, of course, that the gradient of construction is not too steep. Where this is the case, the blocks are laid with quarter-inch joints, and give almost equal conditions, save that the cost of laying is a little more. These close-jointed pavements have the advantages of being almost noiseless, easily cleansed and cheaply maintained. The pavement laid in the earlier days, with the wide joint, each year shows further causes that will ultimately necessitate removal. In this direction the Council has moved during the year, and a work of taking up and re-setting with butt joints the blocks of George-street, in front of the Town Hall, has been ordered, with a view of determining the practicability of treating the wide-jointed pavements throughout the city. The citizens have, from time to time, represented by letters, petitions, &c, the discomfort and inconvenience occasioned by noise of traffic upon wide-jointed pavements, and, no doubt, will hail with pleasure the Council's attention to their appeals; but in addition to this evil, the cost of cleansing and maintaining this class of pavement are disadvantages not met with in close-jointed work. Therefore it may be taken that, in the interests of public health and comfort, and for the cause of economy, and purposes of best construction, the wide-jointed pavements will be abandoned in works of the future, and removed from works of the past, in favour of that already described as economical, comfortable and most healthful.

Wear of Wood-blocks.—Upon examining blocks removed from George-street (which was opened for traffic in October, 1883), blocks of spotted gum were $4\frac{1}{2}$ inches deep, showing about $1\frac{1}{2}$ inches wear during $9\frac{1}{4}$ years, or at the rate of $\frac{1}{6}$ of an inch per annum; blocks of blue gum and grey ironbark showed wear at the same rate. A concise description of each block examined and carefully measured, as shown in tabulated list of particulars here following, will be of value for future comparisons.

Block.	Name of street.	Width of carriageway.	Class.	Position.	Original depth.	Average depth on removal.	Average wear.	Date laid.	Date removed.	Rate of wear per annum.	Width of joint.
		′			″	″	″			″	″
A	George-street	79	Grey iron-bark.	20′ from E. kerb	6	$5\frac{1}{4}$	$\frac{3}{4}$	Oct., 1883	Dec., 1892	$\frac{1}{12}$	1
B	,,	79	Spotted gum	20′ ,,	6	$4\frac{1}{2}$	$1\frac{1}{2}$	,,	,,	$\frac{1}{6}$	1
C	,,	79	,,	18′ ,,	6	$5\frac{7}{8}$	$\frac{1}{8}$	,,	,,	$\frac{1}{73}$	1
D	,,	79	,,	24′ ,,	6	$5\frac{1}{2}$	$\frac{1}{2}$	,,	,,	$\frac{1}{18}$	1
E	,,	79	Blue gum ..	24′ ,,	6	$4\frac{3}{4}$	$1\frac{1}{4}$	,,	,,	$\frac{1}{7}$	1
F	,,	79	,,	18′ ,,	6	$4\frac{9}{10}$	$1\frac{1}{10}$	,,	,,	$\frac{1}{8}$	1
G	Pitt-street	36	Tallowwood	18′ from kerb....	6	$5\frac{3}{8}$	$\frac{5}{8}$	July, 1881	Dec., 1892	$\frac{1}{15}$	$\frac{3}{4}$
H	,,	36	Blackbutt ..	,, ...	6	$5\frac{1}{2}$	$\frac{1}{2}$	Jan., 1886	,,	$\frac{1}{14}$	$\frac{1}{2}$
J	Castlereagh-st.	36	Blackbutt ..	18′ from kerb....	6	$5\frac{17}{20}$	$\frac{3}{20}$	Jan., 1889	Dec., 1892	$\frac{1}{27}$	Butt joint
K	,,	36	,,	,, ...	6	,,	,,	,,	,,	,,	$\frac{1}{4}$ laid diagonally
L	George-street	64	Tallowwood	30′ from W. kerb	6	$5\frac{2}{5}$	$\frac{3}{5}$	Oct., 1883	Dec., 1892	$\frac{1}{16}$	$\frac{1}{2}$

"Thus showing the average annual wear of spotted gum laid with 1-inch joints grouted with tarred screenings (without regarding block C) to be about

one-eleventh of an inch per annum under fairly fast, heavy, and continual traffic. Under the same conditions blue gum may be taken as one-eighth of an inch per annum. Block B.—This block is evidently so much worn, because it seems to have been driven by the traffic through the floating, and by indentations ranging from $\frac{1}{4}$-inch to 1 inch on its base was bearing on the concrete. Block C.—This block, although only showing a wear of about $\frac{1}{8}$-inch (the block being 9 inches long at the top), was decayed for a depth of at least $\frac{1}{2}$-inch at the sides. I can only account for this decay by the absorption of water and extraneous matters which from time to time were collected between the joints to the said depth or perhaps more. I have no doubt that all timber laid upon roadways subjected to similar action would be in a similar state, if not worn to the extent herein stated. In the works referred to in Pitt-street, the blocks were laid with $\frac{3}{4}$-inch with boiling pitch poured in for a depth of 1 inch, then grouted with screenings and hot tar well caulked. In Castlereagh-street the blocks were simply dipped in hot tar, then laid and plugged close up to form a slape joint. The other blocks were laid with $\frac{1}{4}$-inch joints at an angle of 45 degrees across the carriageway. The examples quoted may be taken as the extremes and means. These figures enable me to give the wear of different classes of timbers, and it is decidedly in favour of blackbutt and tallowwood. For example, take the blocks of Castlereagh-street and calculate that Castlereagh-street has a 64-feet carriageway, being the same width as George-street, and then again, inversely take George-street as being the same width as Castlereagh-street, subjected to the same quantity and character of traffic, we will have then a wear of $\frac{1}{48}$th of an inch per annum, and taking George-street to be the same width as Castlereagh-street, instead of having the wear of $\frac{1}{10}$th of an inch per annum, the wear would be $\frac{1}{9}$th of an inch per annum, therefore wood-paving laid, all things being equal, save the width of joint, we have the $\frac{3}{4}$-inch jointed pavement compared with the close jointed pavement as $\frac{1}{9}$th is to $\frac{1}{48}$th, or approximately the life of the close joint pavement is about five times that of the $\frac{3}{4}$-inch joint. This computation is based upon the blocks J, K, and L. For another example we may compare the wear of the $\frac{1}{4}$-inch with the 1-inch joint, for this purpose I take example G and H (tallow wood and blackbutt respectively) and compared with the mean wear of A, B, D, E, and F. Take the average, and upon the assumption as the first calculation, the blocks would wear about one quarter of an inch per annum, if laid in a 36-feet roadway, quantity and character of traffic being equal. Taking case J, and comparing to the average in question, the wear per annum would be as $\frac{1}{27}$ is to $\frac{1}{60}$. Upon these figures the most suitable woods and best methods can be judged, the closer the joint the better the work if laid with tallowwood or blackbutt. My experience of spotted gum leads me to advise that the use of this wood be discontinued." Blocks of tallowwood and blackbutt laid with close joints showed wear during five (5) years of about one tenth ($\frac{1}{10}$) of an inch or at the rate of one fiftieth ($\frac{1}{50}$) of an inch per annum. The average number of vehicles quickly and slowly travelling over the streets from which the blocks have been taken is one hundred and eighty-six (186) per hour, and being mindful of the narrowness of our roadways, it will be easy to arrive at a judgment of the durability of the different timbers dealt with.

Summary.

First pavement and widths of Joint.—In the first pavement the width of joint was one (1) inch, this was subsequently and during a period of six (6) years reduced to three-eighths ($\frac{3}{8}$) of an inch, for by experience it became

apparent that the wide joint caused noise and slipperiness, and the action of the traffic bevelled and rounded edges of blocks to such an extent as to aggravate the two evils named. In 1887 complaints thereupon were numerous and of daily occurrence, hence many propositions to experiment in laying of wood blocks (by methods that had been patented before being submitted), none of which were however considered.

Experiments.—During the early part of 1888 the width of the joint was further reduced to a bare quarter ($\frac{1}{4}$) of an inch when grouted and thoroughly rammed, and, with a view of obtaining the best possible results in the paving of George-street North, provision was made for four different methods of laying and grouting the blocks.

Three-eighths Joint.—1st. The $\frac{3}{8}$ths joint grouted with pitch screenings and tar.

Butt Joints.—2nd. The blocks were laid with butt joints dipped in tar and hammered up close, and afterwards flushed up by sweeping boiling tar and Nepean River sand.

Tarred Felt.—3rd. The blocks were laid on a roofing of tarred felt jointed with strips of the same material and hammered close up.

Sand and Tar.—4th. Three-eighths ($\frac{3}{8}$) joints grouted with Nepean sand, tar, and pitch.

Slipperiness overcome.—This work was completed 5th July, 1888, and since that time in travelling thereon the noise is greatly reduced, and slipperiness is removed by the spreading of sand, which upon wood pavements becomes necessary on "greasy days," irrespective of width of joints.

Best pavement.—All things being equal, the most satisfactory is that laid without grout in the manner following:—The blocks painted on all surfaces with hot tar or wood-preserving oil (preferably with both), and stacked for at least four hours before being laid in the work. Every twelfth (12th) row hammered up close (a plank twelve (12) feet long, six (6) inches deep, and two (2) inches thick, being used as a beating surface. Upon completion of a length of one (1) chain, the surface well swept with hot tar, sprinkled with hot sand, and again with tar, sufficient quantity being used to form a plastic paste, with which the spaces between the blocks were thoroughly flushed up. If wood-preserving oil be used, the joints are flushed up with cement and river sand mixed in the proportion of two (2) of sand to one (1) of cement. Three (3) months' wear upon this section caused the joints to gape and to loosen slightly.

Remedy for Gaping Joints.—To remedy these defects the blocks were well watered, when fairly dry again the joints flushed up with sand and tar as before described, since which the pavement, even though it has been subjected to most variable influences, has maintained a most satisfactory condition.

Pavement diagonally across Roadway.—The work in Castlereagh-street, from Hunter-street to Liverpool-street (fifty-eight (58) chains), afforded opportunity for further experiment, and for a length of eight (8) chains, the blocks were laid at an angle of forty-five (45) degrees to the kerb, by which a wheel in its revolution is on at least two (2) rows of blocks, the noise occasioned by the jarring over the joint is thus very much reduced.

Close Joints Convexity.—In the same street a butt-jointed pavement was laid for a length of seven (7) chains, with a gradient of one in sixty-five (1 in 65) and a convexity of one in sixty (1 in 60). In my opinion, where the gradient does not exceed one in thirty (1 in 30), butt-jointed pavements may be laid with advantage; in such cases the convexity might also be reduced to one in eighty (1 in 80).

Expansion.—In this section to provide for the expansion of the blocks a seam of sand, one and a half ($1\frac{1}{2}$) inches wide, was laid on each side of the roadway, between the kerb and the blocks.

Effect of Traffic.—The pavement has been travelled upon for about five (5) years, and has not yet required any repairs or treatment.

Classes of Timber.—The woods used in these works were of the classes known as blackbutt, blue gum, spotted gum, and tallowwood.

Wood and Macadam.—Traffic upon a closely-jointed pavement does not cause as much noise as that upon a macadamised road, and in anticipation of slipperiness it is reasonable to suppose that it would be overcome by similar treatment as the wider-jointed pavement.

Use of old blocks.—During the years 1887 and 1888 portions of the areas wood-paved with the wide joint were repaved with blocks laid with narrower joints. The old blocks obtained from these areas utilised in the paving of lanes and narrow ways adjacent to wood-paved thoroughfares, the foundations being prepared with the best material obtained from the excavation of the former roadway bedded on a layer of sand three (3) inches in thickness, joints grouted with sand and tar. This is a profitable use for old blocks.

Steepest gradient.—The steepest gradient paved is one in thirteen (1 in 13), and for a length of about one (1) chain the greatest width of roadway is 275 feet, in portion of which there is also the greatest cross-fall, one in seventeen (1 in 17), necessitated to conform with tramway construction.

Wood and Stone.—In the earlier days of wood-paved roadways in Sydney it was customary to lay blue stone cube setts on a bed of sand, spread over a foundation of concrete at the intersection of streets, but after three or four years' wear it was found necessary, for the safety of the traffic, to remove the setts and pave with wood blocks. This afforded an opportunity for comparing the wear of blue stone cubes with that of wood blocks.

Rate of wear, B.S. Cube Setts.—A careful examination of the cubes removed from intersections, after having been subjected to traffic for various periods from five (5) years upwards, an average wear of one (1) inch per annum was shown, while wood blocks removed from Pitt-street, between King and Hunter Streets, opened for traffic during July, 1881, showed wear at the rate of one-sixteenth ($\frac{1}{16}$) of an inch per annum, while blocks laid with butt joints showed wear at the rate of one-fiftieth ($\frac{1}{50}$) of an inch per annum.

Timbers.—These rates are given upon general average, and the woods were of the classes known as blackbutt, tallow wood, and blue gum.

Life of wood pavement.—Upon these results, making full allowance for depreciation and contingencies, the minimum life of wood pavements, as at present laid, may be safely considered as about sixteen (16) years, or from three (3) to four (4) times that of cube setts, while the maximum life may prove to be of about fifty (50) years, provided that the blocks were of thoroughly sound timber.

Flushing Wood pavements.—By the courtesy of the Water and Sewerage Board, the City Council is permitted to flush all the pavements by stand pipe and hose service. By this means, allowing for all circumstances in operation as travelling, time taken in affixing stand-pipes to hydrants, and the contiguity of the respective areas to be watered, I have calculated that the whole area, wood-paved, could be thoroughly flushed, swept and cleaned by twenty (20) men in eight (8) hours. I am doubtful about the effects of flushing wood-paved roadways, its chief advantage being ease of cleaning. On the other hand, in Sydney streets buildings having been built much higher than the

width of the roadways, the sun's rays are not effective in drying the blocks, consequently there is a dampness and humidity that in some cases have set up a decay.

Climatic influence.—The climate of the Colony is not so favourable as that of other lands in assisting the preservation of timber. Here we are subjected to long spells of hot, dry weather, followed by heavy rains, and at times great falls in the temperature take place. These circumstances must have a prejudicial effect on timber, and have no doubt that in more moist and even climates our colonial timbers would have better advantages. Writing generally upon these operations as affecting all wood pavements—first, in case of wide joints, the grouting was scoured out to depths varying from half-an-inch to 2½ inches. The blocks loosened and rocked under traffic. The narrow joints were not thus affected, but the soakage between the blocks seemed to soften the surfaces and round the edges to such a degree as would probably shorten the life of the pavement. A pavement properly laid, that is with close joints, can be well cleaned and easily maintained by a judicious watering (not flushing) and simultaneously sweeping.

Cost of blocks.—Blocks for these works were supplied under special contract, and the prices per thousand varied from six pound fifteen shillings and sixpence (£6 15s. 6d.) to nine pound seven shillings (£9 7s.)

Cost of wood-paving.—The cost of wood-paving, including excavation, &c., varies from about twenty shillings to twenty-five shillings (20s. to 25s.) per yard, according as the convexity in the roadway may necessitate more or less excavation.

Pavement with cement grout.—In conclusion I am not favourably impressed with the result of cement grouting; but where same is employed the blocks should be separated with three-eighths (⅜) studs, so as to form a triangular holdfast before filling in with cement grout. Taking one-quarter (¼) inch or three-eighths (⅜) inch space as a case for treatment, it seems to me that either is not sufficiently wide to give a strong body of grouting, and moreover in hot weather there is danger of the mixture becoming weakened during operation. I am therefore diffident in qualifying this as one of the best methods of wood paving, and if it be employed the blocks should be thoroughly coated with wood-preserving oil, so that any deleterious effect of the cement upon the timbers will be neutralised. Such a pavement is likely to require constant attention in all changes of season.

Best form of pavement.—The best form of pavements where gradients will admit, is certainly that with close joints, and I believe that any of the following timbers would suit admirably for so paving roadways: Blue gum, red gum, blackbutt, tallow-wood, mahogany, and turpentine.

Soft woods, close joints.—I am also inclined to think that softer timbers laid in this manner would give good results, and shall at the first opportunity put them to the test. I have endeavoured herein to embrace all information that, in my opinion, is required to meet the purposes of your inquiry, and if I have omitted any I shall be honored with the privilege to supply. Trusting that that contained herein will meet the purposes intended.

I have, &c.,

R. W. RICHARDS,

Assoc. M. Inst. C.E., M.M. & C.E., City Surveyor.

Contributions to an Economic Knowledge of Australian Rusts (*Uredineæ*).

N. A. COBB.

CHAPTER X.

Improving Wheat by Selection.

We have shown how to produce a cross-bred wheat, and have called attention in a pointed manner to the characteristics of the varieties of wheat, as we now find them. We have shown how an experimental wheat plot should be prepared, planted, and cared for. Let us now imagine the crop to stand before us, and proceed to consider how wheat may be improved by selection, for be it remembered that it is always by selection that wheat is ultimately improved, and that upon the degree of skill shown in selecting, depends the amount of improvement we make. Cross never so skilfully, and then select badly, and the result will be unsatisfactory. To make a cross requires some degree of skill with the hands, and good judgment as to the kind of cross it is desirable to make. Selection requires qualities of a far higher order.

Wheat is grown in such a variety of ways, harvested and prepared for the market with such a variety of implements, put to such a variety of uses, ground in such a variety of mills, that selection becomes the result of a very complicated set of factors.

In this work we would very willingly avoid the consideration of these numerous factors, but we cannot. The problem before us, namely, that of reducing as much as possible the loss due to rust, is too closely connected with them to permit us to ignore them. In fact the reader will see as he goes on that it is these very factors that have more to do with our problem than any others.

The experimental wheat-plot stands before us, presenting a large number of varieties of wheat. Each variety is composed of plants nearly alike, but still no two are exactly alike. Among all the plants in the plot there is one that is best. How shall we find it? If we can but find it, and sow its seed, we shall introduce on our farm a sort of wheat that will yield us larger crops, give us better incomes, and help to reduce the price of the world's daily bread. Surely this is a grand problem to set ourselves to solve, one worthy of our best efforts!

In order to find and select the sort of wheat-plant, which, on the whole, is the best for us to grow, we must consider every factor in the growing, and in the manufacture into food-stuff. We must consider which plants suffer least

NOTE.—The fact that few of the laws that govern the result of a wheat-cross have been discovered, render good results largely a matter of chance. The best compensation for this disadvantage is the making of a large number of crosses. Out of a large number some good results are sure to follow.

from rust, and of such which yield the largest quantity of good grain. We have already given a scale by which the amount of rust on a given plant may be noted down for comparison with that found on other plants. The scale we believe to be by far the best yet contrived, and the only one with a definite basis, namely the area on the surface of the plant which the rust has succeeded in covering. Our 5 per cent. means that the rust has covered 5 per cent., or one-twentieth of the area of the plant or part examined. Our 10 per cent. means that the rust has covered 10 per cent. or one-tenth of the surface, and so on. Our scale is accurate, scientific. It is at the same time simple and easy of application. The method of application has been already described. It may be well to add that it is equally applicable to sheaths and straw. This is not so readily understood, but is clear at once when we state that the width of the unrolled sheath or straw is the same as, or corresponds with, that of the flag or blade.

The plants to be first selected are those most free from rust. If the experimental plot has been made as directed in the chapter on experimental wheat-plots, that is to say, with every other drill a very rust-liable sort such as Golden Drop, we may be reasonably sure that the plants most free from rust are those having rust-resistant, or rust-escaping properties. But it must never be forgotton that we cannot be absolutely certain of this. It may be that for some reason we do not know, a particular plant may escape being rusted, and yet possess no great power to resist rust. There is no more practical plan for guarding against this uncertainty than that we have advocated of sowing every other drill with a rust-liable sort.

At this point attention should be directed to the fact that some plants have a power to endure rust. It will be remembered that we proposed the terms rust-proof, rust-resistant, and rust-escaping, as descriptive of different kinds of wheat. To these three might be added a fourth, *rust-enduring*. A rust-enduring wheat is one which, though liable to rust, is able, notwithstanding the attack of the rust, to mature a fair crop of grain under ordinary circumstances. This term has a more limited and less certain application than the other three, but will nevertheless be found useful.

The close-reasoning reader may at this point remark that after all, then, the selecting of least-rusted plants is superfluous, since some that are rusted may, in spite of rust, yield better than those not rusted, being rust-endurers, and this remark would be pertinent were it not for the fact that rust-enduring wheats are, to say the least, uncommon, and that furthermore we know at best very little concerning them.

As to the time of the year at which to make observations on rustiness, it may be said that the time when the crop has begun to turn, and after the nature of the yield is no longer uncertain, is the best; but for reasons to be given later on, the amount of rust at all seasons is worthy of observation.

Having found and marked the least-rusted plants, we allow them to mature their grain thoroughly, meanwhile noting how the plants behave in respect to the weather. These considerations are very important, as will be understood at once when we point out that the weather may succeed in so breaking down a wheat as to cause loss in harvesting or cause it to shell so freely as to reduce the yield. When the grain is ripe the relative earliness and yield of the various plants is ascertained, also the nature of their growth as related to harvesting machinery as well as the quality of their grain.

It will be seen from the foregoing brief outline what a large number of things have to be considered before deciding on the best wheat. Let us now make a table of the various points to consider, and then treat each point in detail.

I.—Selecting plants free from rust or nearly so:—

1. Rust on the flag.
2. Rust on the sheath.
3. Rust on the stalk.
4. Rust on the ear.

II.—Selecting plants for prolificness:—

5. Stooling; number of heads.
6. Sterile spikelets.
7. No of grains in a spikelet.

III.—Selecting for shape of grain:—

8. Long grain.
9. Pointed grain.
10. Round grain.
11. Shallow crease.
12. Small grain.
13. Small brush.
14. Thick bran or thin bran.

IV.—Selecting plants that hold their grain up to be harvested:—

15. Weak straw.
16. Flexible straw.
17. Stiff straw.
18. Brittle straw.
19. Long and short straw.
20. Beards, at least at the end.
21. Shelling on account of weak chaff.
22. Shelling on account of brittle chaff.
23. Shelling on account of loose heads.
24. Shelling on account of leaning or pendulous heads.
25. Varieties with a red chaff.

V.—Selecting early, midseason, or late wheat:—

26. Earliness and tough cuticle.
27. Earliness and great glaucousness.
28. Earliness and small foliage.
29. Earliness and weak straw.

VI.—30. Selecting plants for shortness of time between earing (not flowering) and ripening.

VII.—31. Selecting plants for narrow erect foliage.

VIII.—32. Selecting plants for toughness of foliage.

IX.—33. Selecting plants for glaucousness.

X.—34. Selecting plants for hairiness.

XI.—Selecting shapely plants:—

35. Heads all at one height.
36. Heads ripening all at the same time.

Our table gives thirty-six points to consider. We shall take these in succession, and devote a short paragraph to each.

I.—Selecting Plants free from Rust or nearly so.

Under this head it is to be noted that wheat with a purple straw is almost universally more liable to rust. The so-called purple-straws are all very rust liable. Even among wheats that are more or less resistant to rust, as for instance the Fife wheats, those showing a tendency to purple straw are more liable to rust than those not showing that tendency. The Fifes, as a rule, have whitish or yellowish straw; if, however, a single plant or a strain of Fife shows a slight purple hue in the straw such plant or strain will usually present more rust than other Fife plants. We have also seen some reason to believe that velvet-chaffed fine wheats (*T. sativum*) are more liable to rust than those with smooth chaff. From this one might argue that if a degree of hairiness could possibly hinder the attacks of rust, it must be a greater degree than we see on any of our present velvet-chaffed sorts.

It will be noticed at once on proceeding to select plants comparatively free from rust that such plants occur more frequently among bearded varieties. Perhaps we might put it better by saying that bearded varieties are relatively freer from rust. There is, however, an objection to bearded wheat on account of the trouble it gives in threshing. We have made observations and experiments, which we shall present in a later chapter, which lead to the important conclusion that the beard of bearded wheat can be made to drop off in ripening, and therefore cause no difficulty in threshing.

1. *Rust on the Flag.*—It is a common saying that rust on the flag does no harm; but this is false. How any sensible wheat-grower can make such a statement is beyond our comprehension. Did he ever see wheat yielding 40, 50, or 60 bushels to the acre? And did he see any rust on the flag of that wheat? We are sure he would look a long time before finding much. Moreover, one of the very good reasons for the high yield of that wheat was the absence of rust from the flag. Had there been much rust on the flag the yield would never have reached anything like 40 bushels to the acre. One might as well say there is no harm in a horse having only a peck of chaff per day and nothing else. To be sure, he might live, but very little work could be got out of him; he would be about as profitable as rusty wheat at 7 bushels to the acre, and for the same reason, namely, lack of food. What is meant by the declaration that rust on the flag does no harm, is that as long as the rust is confined to the flag there will be *some* grain in the head. This is true; it is equally true that if there is no rust on the flag there will be very much *more* grain in the head, unless some cause that has no connection with rust prevents. We would like to point out, moreover, that every bushel per acre gained by absence of rust from the flag is clear profit, and that it is just such points as these that it is, now-a-days, the most necessary to consider. If there is no rust on the flag there will be none elsewhere. Let us abandon for ever this fallacy that rust on the flag does no harm. Does no harm! Why, the flags are an important part of the breathing system of the wheat plant, and, furthermore, furnish a considerable amount of its food! Would a man be just as well off with one lung, and half-starved? The idea is ridiculous.

If selection for a minimum of rust on the flag takes place among separate plants, then the operation is simply a comparison of the flags of separate plants with each other. In this case no scale of rustiness is absolutely necessary, but it will be found a great convenience. If, however, a large number of plants of one variety are to be compared with a large number of plants of another variety, then a scale of rustiness becomes an absolute necessity if accurate and valuable work is to be done. It is wholly unsafe to take a general look at one variety and then at another, and endeavour to

say which is the more rusty, if, as is very often the case, the two differ from each other by no more than 10 per cent. We have frequently done our very best to judge between two sorts under such conditions, afterward testing our judgment by actual measurement. We find that we judge wrongly as often as rightly. The difficulty is all the greater if any amount of time elapses between the two judgments, as in the case of comparing one season's results with another's. How much greater is the difficulty, therefore, in comparing one person's judgment with another's. These remarks on the necessity of a scale of rustiness apply equally to judging the amount of rust on the sheath and straw. The only scale yet proposed, which is based on an absolute unit, is that which proposes to express the amount of rustiness in terms of the area covered by the rust. This method is capable of being carried to any degree of accuracy whatever.

It is hardly necessary to point out that attention has often to be confined to the rust on the flag, especially among wheats that have been already worked a season or two, for the reason that the rust occurs nowhere else on the plant.

2. *Rust on the sheath.*—Judging the amount of rust on the sheath is similar in every way to judging it on the flag. Unroll the sheath and it has nearly the same width and appearance as the wider part of the flag, of which it is, in fact, a continuation. Rust is usually less abundant on the sheath than on the flag for the following reasons:—

a. The sheath is vertical, and, therefore, catches fewer spores.

b. It is more glaucous than the flag, especially than the upper side of the flag.

c. The cell-walls of its cuticle are thicker and tougher.

3. *Rust on the stalk.*—This is judged precisely like that on the sheath. One may easily acquire such facility in comparing the sheath and stalk with the paper rust scale as to make it unnecessary to split them open.

It is a matter of importance to note the kind of rust observed. An idea has been gaining ground that it is possible to dispense with a microscopic examination of the spores before deciding which rust is doing the damage, and we are sorry to say that we have been among those blamable in countenancing this idea. There is no absolutely certain way of distinguishing *Puccinia graminis* from *P. rubigo-vera* except by microscopic examination of the spores, and we have now abandoned every other. In its young stages *graminis* "spots" the flag in the same manner as the *rubigo-vera;* and in the later stages the *rubigo-vera* often "streaks" the stalk in precisely the same manner as the *graminis.*

If much rust occurs on the stalk, above the upper leaf, before the grain is filled, the grain will surely be pinched. The appearance of rust on the stalk, therefore, is a fact to be specially noticed.

4. *Rust on the Ear.*—This is a matter requiring little notice as no particular advantage is gained by knowing about it. It is customary with us, after having gone through a lot of wheat and determined what plants to throw out on account of their rustiness, to go again through the plot at once with a sickle, and remove all the discarded plants. This leaves the plot in better condition for the further selection of the best yielding plants, &c.

II.—Selecting Plants for their Prolificness.

The ultimate test of the prolificness of a plant is the weight of its dry grain. The weighing of large numbers of small lots of wheat is, however, such slow work that we often have recourse to other means of judging the

prolificness of a plant especially as there are some objections even to the method of weighing. We find that the ordinary spring-balance sold for weighing mail matter up to 1 lb. is most convenient for weighing the produce of a single plant. Remove the pan supplied with the balance, and put in its place a condensed-milk tin of the same weight and nothing better could be desired.

5. *Stooling.*—Good-yielding plants stool or tiller well, that is, produce a large number of heads. A single grain of wheat has been known to produce upward of 100 heads, but thirty to fifty is a very good number. Where a stool appears to have an unusually large number of heads, always look out that the stool did not grow from two grains instead of one. We have seen ridiculous mistakes arise from this source. If the stool be pulled up, and its roots be cut away with a knife, it is usually easy to see if all the stalks start from one grain or centre.

6. *Sterile spikelets.*—It is impossible to judge of the prolificness of a plant by merely counting the heads. It is necessary to know what grain the heads contain. One thing that reduces the amount of grain in some apparently large heads of wheat is the number of sterile spikelets, that is, spikelets at the bottom of the ear which contain no grain. The number of sterile spikelets may reach as high as six or seven. To have a large number of sterile spikelets at the base of its ears is, therefore, a bad quality in a wheat. The plant goes to the trouble of producing chaff, and puts no grain in it; this is waste of energy.

7. *Number of grains in a spikelet.*—This is a matter which determines more than any other the yield of a head of grain, but it is not a mere matter of number; the size of the grain must also be considered. The number of grains may reach five or six; commonly it is three or four. The uppermost grains are smaller than the others—sometimes very much smaller. Many wheats which produce but two grains to the spikelet are nevertheless good yielders, the two grains produced being large and heavy. A variety of wheat varies considerably from season to season in the number of grains produced by its spikelets. Grains sown from a head bearing four grains to the spikelet may give rise to heads with three grains per spikelet, and the reverse may also take place and a three-grain wheat produce four-grain progeny. The exact number of grains depends on the nature of the season, and the method of raising the wheat. If wheat be top-dressed with suitable manure at a time when the heads are first peeping forth, and rains follow so as to wash the manure into the ground, the heads will nearly always produce spikelets with a large number of grains in them. Where wheat is grown on a small scale in mixed farming this is a fact worth knowing, as with suitable means a small area of wheat can be top-dressed to suit the weather.

III.—Selecting for Shape of Grain.

This is a very important part of selecting, the guiding principle of which is the mathematical truth that a round or spherical surface is that which will enclose the maximum of space for a given amount of surface. Thus, a square inch of surface will enclose the most space if disposed in the shape of a sphere. The application of this principle to the grain of wheat is quite simple. We have to remember that the surface part of a wheat-grain is bran, and of little value as food, while it is the great bulk of the interior that is ground up into flour and other food-stuffs. The more nearly a wheat-grain resembles a ball, the less bran it will have in proportion to its flour, and, on the other hand, the more it departs from being round like a ball the

more bran it will have in proportion to its flour. From these statements it might be inferred that round-grained wheats are to be preferred, but it will soon be seen that the exact opposite is true, and that long-grained wheats are of the greatest value.

8. *Long grains.*—The value of a grain of wheat as a food producer depends on the amount of food it produces, and the nature of that food. Roughly speaking, the food is of two kinds—starch and gluten. The main portion of the interior of a wheat-grain is starch. Immediately under the bran however is a layer of gluten. Gluten is a nitrogenous food-stuff, as meat is, and it is consequently worth more than starch. From this it follows, roughly speaking, that the more gluten a grain contains, the more the grain is worth, providing the gluten is of the right sort. Since the gluten lies next the bran, and therefore near the surface of the grain, it follows that the greater the surface of the grain is in proportion to its bulk or weight the more gluten it contains, and inasmuch as long grains are those that depart most from the round or spherical shape, they are precisely the grains that contain the most gluten, other things being equal. Thus far the matter is comparatively simple, but complications arise in the following manner: While up to a certain point the gluten in a grain is first in importance, there comes a point at which it is necessary to consider the bran. For instance, let us imagine a grain of wheat to become as long and slender as a sewing needle, its gluten layer would be very large, but along with it, and everywhere covering it, would be bran, and the proportion of bran in such a long and slender grain would be so great as to reduce its value very much as compared with a shorter grain. This would not be the case if the bran were a mere mathematical surface having no thickness; but of course such is not the case, the bran having an appreciable thickness. As a corrolary to these facts, it follows that the thinner the bran, the longer a grain can be, and rise in value on that account; or, to put it in another way, thin-skinned wheats should be selected for longer grains than thick-skinned ones. It goes without saying that for centuries it has been an object to reduce the thickness of the bran or skin on the grain of wheat.

9. *Pointed grain.*—A little thought will make it clear that a pointed grain demands more surface than a blunt one to contain a given amount of food-stuff, and therefore will contain more gluten in proportion to its starch.

10. *Roundish grain.*—By a train of reasoning opposite to that given above, it can be shown that roundish grains give less bran to a given weight than grains of any other shape. Connected with this small amount of bran of course is less gluten, unless indeed the gluten layer is thicker than usual, which is sometimes the case with roundish grains. It follows that in selecting wheats yielding roundish grains careful attention should be given to the thickness of the gluten layer, and only those selected that have a thick layer.

11. *Deep crease.*—The general contour of a grain of wheat approaches more nearly to an ellipsoid of revolution than to any other simple mathematical figure, and in the sections immediately preceding it may, for purposes of rough comparison, be regarded as in reality an ellipsoid. In reality, however, it is divided nearly in two by a deep crease; it is, in fact, two ellipsoids joined together. The bran goes to the bottom of the crease; as does also the gluten layer. From this it follows that the deeper the crease the more there is both of bran and gluten, but the grain increases in value with the depth of crease, up to any extent yet known to occur.

12. *Small grain.*—The surfaces of similar solids vary as the squares of their diameters, but the contents vary with the cubes of similar dimensions, from which it follows that it is better up to a certain limit to enclose a given

amount of food material in two bran-husks than in one. Compare a large grain of White Lammas, for instance, with a small grain of Allora Spring. Let the White Lammas grain weigh as much as 2 grains of Allora Spring. Then the bran on the two grains of Allora Spring will be considerably greater than that on the one grain of White Lammas, and of course the gluten content of the Allora Spring would be greater if the gluten layer was equally thick in each sort, an assertion which we do not make. It is worthy of notice, though well known, that small-grained wheats give the greatest weight to the bushel

13. *Small brush.*—The brush is worthless as food. The less there is of it the better.

14. *Thick bran and thin bran.*—For centuries millers have selected wheat for thinness of bran. The thinner the bran the more flour the miller gets from a given weight of wheat, and hence the more profit he secures. This fact has served to call continual attention to the desirability of thin bran. Wheat has accordingly gradually changed, until now ordinary marketable wheat presents a bran thinner in proportion to the size of its grain than can be found on any seed of similar plants (grasses) growing wild. The millers' test for the amount of bran is the best of all, namely, the amount of bran yielded when the wheat is well milled. This test, however, is not applicable by the miller to a small quantity of wheat, a fair sized mill requiring, when running as usual, about 20 to 50 bushels of grain, in order to give a reliable return as to bran and other products. The only tests that can be applied to small quantities with satisfactory results we believe to be a microscopic examination of a cross-section of the grain. We made examinations some years ago that led us to this belief, and further observations have confirmed our first opinion. In a later chapter we give additional information on this point.

IV.—Selecting Plants that hold their Grain up to be Harvested.

15. *Weak straw.*—By weak straw we mean straw of such a nature that the weight of its own heads and foliage causes it to sink down, or lean over and fall down without breaking. To select against weak straw, allow the plants to stand until dead ripe, or even longer, and then harvest only from those plants that still remain upright.

16. *Flexible straw.*—Flexible straw, or that which bends under the weight of the heads and sometimes even allows the heads to hang down, is harder on reaping and threshing machinery than most other sorts, for several reasons. Though flexible straw is usually small, it is always semi-solid, or solid, at least near the top, and therefore it is not more easily cut, on account of its small size, especially by stripping machines. Flexible straw is more likely to become tangled than stiff straw and is therefore managed with greater difficulty, because it often presents itself to the machine in an oblique fashion. Binding is also a little more awkward where the straws are curved, as is usually the case when they are flexible.

17. *Stiff straw.*—The bad qualities mentioned under flexible straw are a sufficient explanation of why stiff straw is desirable.

18. *Brittle straw.*—Brittle straw is easily broken by the wind, and the heads that fall down from this cause cannot be harvested by machinery. Brittleness is usually caused by the straw being thin-walled.

19. *Long and short straw.*—Whether long or short straw is desirable depends on the market value of the straw and the facilities the farmer has for putting it up ready for the market. As a rule, in the Australian

colonies the straw is not a valuable product, and beyond doubt short-strawed varieties are to be preferred. There are several reasons for this. In the first place, long-strawed varieties shell more because their straw is usually flexible, and the heads, being high above the ground, are more knocked about by the wind. In the second place, the energy (down to a certain limit), which they use up in making straw would be more profitable to the grower if put into making grain. On the other hand, short-strawed varieties of wheat generally stand up erect and hold their heads erect (an advantage, as we shall see directly) and do not allow the wind to get so much purchase as to batter the heads about and cause the grain to be shaken out on to the ground. The best straw for a variety of wheat is a short stiff one of large diameter having rather thick walls.

20. *Beards.*—Beards on a head of wheat serve to prevent shelling by lessening the shock of impact against other heads when knocked about by the wind. This advantage is counteracted to some extent by their liability to become entangled with those of other heads. Where the heads are thick together, even a few prominent beards at the top of the ear only are an advantage in a gale of wind.

21. *Weak chaff.*—Weak chaff lets the grain fall out. It is thin and flabby, and when the ripe ear is struck smartly the grains fly in every direction because the chaff is not stiff enough to retain its hold on the grain. Weak chaff is the commonest cause of the great evil, shelling. Stiff chaff is usually white or yellow, and is commonly glazed on the surface; its colour is its own. Weak chaff is so thin and translucent as to allow the colour of the grain to show through; its apparent colour, therefore, is derived partly from that of the grain. Weak chaff, when not tinted with red, is usually very white and flimsy-looking; even when tinted with red its white parts where protected by overlying chaff is equally flimsy looking.

22. *Brittle chaff.*—This is a cause of shelling very distinct from the preceding. Brittle chaff breaks away from the ear too easily. Its attachment to the axis of the ear is easily broken, and when it falls away the grain goes with it. Wheats with a brittle chaff, when ripe and subjected to a few days of dry windy weather, lose all their grain, the top of the stalk being reduced to a mere zigzag.

23.—*Loose or open heads versus close or compact heads.*—An ear of wheat is said to loose or open when the spikelets composing it are separated from each other by a considerable distance. In close ears the spikelets touch each other. It is evident that the latter sort are less liable to shell, other things being equal. Each spikelet bears against and supports its neighbour, and this hinders the grain from easily escaping from its envelopes. Even varieties, with naturally weak or brittle chaff, may be wholly or partly prevented from shelling by this means. Loose heads catch more wind, and therefore are more knocked about in a breeze, and this is a disadvantage. From what we have just said it is evident that unless a variety has very stiff and firmly-attached chaff, selection to improve it must be directed towards giving it a compact head. It is doubtful if any advantage whatever results from a loose head.

24. *Leaning or pendulous heads.*—Heads which lean over or hang down are, of course, more likely to lose their grain than upright heads.

25. *Varieties with red chaff.*—So far as we have observed, varieties with red chaff are quite liable to lose their grain by shelling. There are a few marked exceptions however.

V.—Selecting Early, Mid-season or Late Wheats.

There is a great advantage in sowing wheats that vary as to their time of ripening. In these colonies preference will always be given to early and mid-season sorts. There is no difficulty in the way of selecting for earliness. We only wish to warn against judging ripeness by the outside appearance of the ear. Judge always by the grain. The ears of some sorts appear quite ripe when the grain is still in the milk, while other sorts harden their grain almost before the ear has ceased to be green.

As selection will hereafter be largely directed toward earliness, we wish to call attention to three or four natural incompatibilities to which it will be necessary to give close attention.

26. *Earliness and a tough cuticle.*—The quick growth of early wheats naturally prevents the processes from being as thorough as in the slower growth of later sorts. This result of pure reasoning is confirmed by observations. The cuticle of early sorts is not as tough as that of late sorts and this is the reason why early wheats are so liable to rust.

27. *Earliness and great glaucousness.*—Great glaucousness is found in late wheats, but rarely, if ever, in early ones. The reason is probably the same as that for weak cuticle, namely, that the quick growth of early wheats gives little time for the elaboration of the waxy covering that causes glaucousness.

28. *Earliness and small foliage.*—Early wheats have large foliage in proportion to their size. This, again, is in harmony with their quick growth. It will probably be useless to select early wheat for small foliage. If the plants with little foliage be selected the progeny will be later.

29.—*Earliness and weak straw.*—Another and often disastrous result of the quick growth of early wheat is weak straw. No early wheats have very strong straw, and the breeder of early wheats will always be obliged to give special attention to this point. The consideration of 26, 27, and 28 is sufficient to show why early wheats are so liable to rust, and it seems probable that in view of these facts, we must go in for earliness regardless of liability to rust, and not expect to get a wheat both early and resistant. As for the weak straw, that can doubtless be avoided by selection. There will always be a tendency towards dwarfness in early sorts. An attempt should be made to associate earliness with smallish plants, having large foliage and short internode, and especially a short stalk.

VI.—Selecting Plants for their Manner of Ripening.

30. *Shortness of time between earing and flowering.*—The decisive struggle between the rust and the crop takes place on the stalk, *i.e.*, the portion of the straw above the topmost leaf and below the ear. If much rust succeeds in finding a lodgment in that locality before the grain is matured, the ear is, as it were, strangled, or, perhaps better, starved. The grain, in maturing, draws its food from the leaves and straw below, and this food is passed up to it through the stalk. If, therefore, rust has already attacked and mutilated the stalk, the grain has great difficulty in securing its food. It becomes pinched. The stalk is first exposed to the action of rust after the ears first peep forth, and it remains exposed until ripe. Now, the shorter this time is the less chance there is of the rust gaining a footing on the stalk. It follows, therefore, that the shorter the period between the earing-out of a wheat and its ripening the better. Wheats vary greatly in this respect, and we are satisfied that there is abundant room for improvement of all our varieties in this respect.

31. *Heads ripening all at the same time.*—Some plants have a dawdling way of ripening their ears. Long after the larger and uppermost ears are ripe the others lag. This is a weak point, and should be selected against. Never use for seed the grain obtained from plants having this irregular habit of ripening. No matter how fine some of the heads may be, their seed can only give rise to plants having the same bad habits. We have observed this again and again.

VII.—Selecting for Narrow, Erect Foliage.

32. The virtue of erect foliage consists in the facts that spores are less likely to find a lodgment on such foliage, and that such foliage is associated with a tough and glaucous cuticle. The latter fact is the more important of the two. Erect foliage is usually narrow and thick for its width.

VIII.—Selecting for Toughness of Foliage.

33. Selecting for toughness of foliage resolves itself into testing the tensile strength of the flag. This is a matter that has occupied our attention for several seasons, and some of our most promising strains of our known varieties have been a direct result of this sort of selection. The matter has been so fully dealt with in chapter VI, that we need not consider it at greater length here.

IX.—Selecting for Glaucousness.

34. The nature and effect of glaucousness, as related to rust, have been described in chapter VI, and we shall therefore only briefly allude to the matter here. Plants which, when they are young, have a dark-green colour—that is to say, a dark blue-green, as opposed to a yellowish green colour—generally begin to acquire a white and waxy (glaucous) appearance as soon as they begin to shoot up. Such plants, on a dewy morning or after a rain, always have what little water has succeeded in clinging to them collected in large drops. They refuse to wet on account of the aversion which their waxy covering has to water. Water does not readily adhere to them. Such plants are more resistant to rust than they otherwise would be. Late varieties of wheat are more inclined to be glaucous than others. Glaucousness is usually associated with a tough cuticle.

X.—Selecting for Hairiness.

35. Hairiness, to be in any way a protection against rust, must obviously be of a greater degree than any known to occur on any part of the wheat plant.

XI.—Selecting Shapely Plants.

36. A model wheat plant should bear its heads as nearly as possible all at the same height. This uniformity in the height of the heads is an advantage at harvest time, as all harvesting and threshing machinery works to greatest advantage on even feed. Where heads are all of the same height they furthermore ripen all at the same time, and, as we have shown, this is an advantage.

This finishes our enumeration of the points that have to be considered in improving wheat by selection. The way in which each sort of selection is made has been also indicated. We have only to add a few words in reference to a systematic way of applying the different selections.

The time to begin the work of selection is while the plants are still entirely green, but are on the point of turning colour preparatory to ripening. There are special points that can be observed to advantage before this period, but on the whole the greatest good with the least labour can be accomplished at about the time specified, which occurs while the plants are in flower and a week or two afterwards. The plants that are compared with each other should be as nearly as possible of the same age. First of all the plants are selected for rustiness; then they are submitted to each test in turn somewhat in the order in which we have given them. The plants which fail to come up to standard are discarded, or cut out altogether. The plants which remain are used as seed the following season, and again improved until a quality is reached suitable for the market. The novice in this work will be surprised at the small number of plants he has left after applying all these tests, perhaps only a few out of a thousand, or even only one. But as he continues year by year he will be gratified by seeing a gradual change for the better in the quality of his experimental wheats, and as the best are used to re-stock the farm, the great good of having an experimental plot will come home to him with irresistible force.

As we have before remarked, we are advocating nothing new in principle. There are already farmers in all directions who have for years, as their ancestors did before them, practised the art of selection. We wish only to call attention to the fact that this matter of improving seed by selection is worthy of the careful attention of everyone who makes his living by raising wheat, and that the experimental plot, even if small and devoted to only a few or even only one variety, is a valuable addition to any wheat-farm. The prosperity of any wheat-grower will be largely in proportion to his heed to the facts we have enumerated.

If no one has previously proposed so precise and elaborate a scheme of selection it is simply because no one has before given the subject sufficient attention; the conclusions we have arrived at are only those which common sense would inevitably reach with a little patient observation and reasoning. We should, perhaps, have been a little less elaborate were it not for the fact that we hope also to secure the attention of specialists, or would-be specialists.

One thing we have perhaps not made sufficiently clear. It is this, that all selection should be made by plants, and not by heads. There is a common practice of going through a crop, and plucking the best-looking heads for seed. This is better than nothing, but it may easily happen that the large and fine head is the only good head on the plant from which it was plucked. Its seed, therefore, would tend to produce similar uneven plants to that from which it came. Obviously, the only way to secure good seed without failure is to give full attention to the *whole plant* from which it came.

CHAPTER XI.

Harvesting Experimental Wheats.

The harvesting of experimental wheats differs from ordinary harvesting on two accounts—first, the necessity for greater accuracy; and second, the smallness of the lots harvested. Where the crop exceeds half a bushel, ordinary methods are best; but where only a few ounces or pounds of seed are to be harvested, a number of methods are used which will be of service to those who are following the recommendations in the previous chapter.

The reaping is accomplished with a sickle where many consecutive plants in the same drill are to be cut, as, for instance, in thinning out undesirable plants. Our plan is to go ahead of the workman, and indicate by pointing the plants to be cut. The workman cuts and binds into sheaves. Where, however, marked plants here and there in a plot are to be harvested the better way is to employ a pocket-knife. The blade may be small. The stalk is cut just below the ears, and the crop is placed in a bag hung to a strap round the waist, as shown in the accompanying engraving. A label is placed in the bag, as well as tied on outside. It is unnecessary to add that the label should give any necessary specifications, such as kind, quality, date, &c.

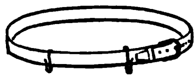


Fig. 106.—Strap and buckle to be used as a belt for supporting calico bags in harvesting experimental wheat. Two wire hooks are attached to the belt as shown in the figure, and upon these the bag is suspended, as shown in Fig. 107.

Fig. 107.—Showing the method of harvesting heads from selected wheat plants. The calico bag is worn as an apron attached to the belt, shown in Fig. 106.

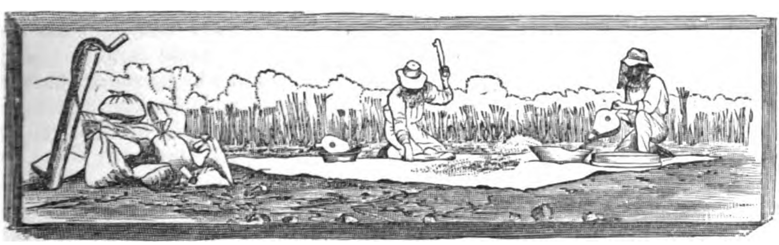


Fig. 108.—Sketch showing method of threshing and winnowing small lots of wheat where the whole yield is only a few pounds or ounces, as described in the text.

The threshing is accomplished by beating the bags containing the heads of wheat on a stone or plank, or by beating the bag with a stick, such as a piece of broom-stick.

The winnowing is done with a winnowing machine, if the grain measures half a bushel or more, but otherwise is accomplished in some other way. It is unnecessary to state that the machine must be scrupulously clean before commencing operations, otherwise the seed might become mixed. If the quantity to be winnowed weighs only a few pounds, it is first sieved in a common round hand-sieve, quarter-inch mesh. This is done on a large piece of canvas, which has been shaken free of seed. The grain is sieved into a large prospector's pan. If the wind is blowing, nothing further is necessary than to pour the seed shoulder-high from one pan to another to winnow it in a few minutes. If there is no wind, a pair of bellows will soon blow the chaff out of the pan, and leave the wheat winnowed. The seed may be sieved to secure the different sizes—or better, where the quantity is very small (an ounce or two), picked over by hand. The accompanying sketch gives a better idea of the operations than any amount of description. The work is facilitated if a very large movable table can be carried to the plot to lay the canvas on, so as to enable the men to work standing up.

The grain is best stored in bags—not in bottles, or it will soon lose its germinating power. The bags should be of good calico, and should be very

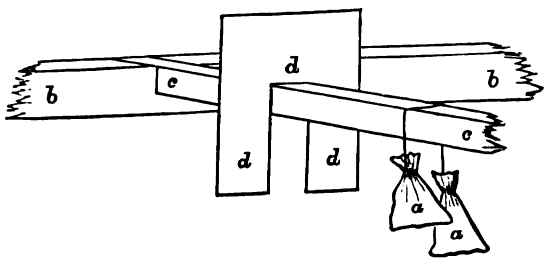


Fig. 109.—Contrivance for preventing mice and rats from getting at wheat hung over a rafter. *a a*, Small bags of wheat; *b b*, beam passing along the eaves of barn; *c c*, rafter; *d d d*, piece of sheet iron preventing mice from passing along *c* to the bags. Of course the other end of the rafter has to be guarded by another similar piece of sheet iron.

tightly tied at the mouth. The bags are best hung over a rafter or wire in the loft. We once saw at Mr. Wm. Farrer's farm an ingenious protection against mice, devised by him. It is explained in the adjacent figure.

Entomological Notes.

By A. SIDNEY OLLIFF,
Government Entomologist, New South Wales.

Bees-wax Moths.

The bee-moths, or bees-wax moths, of which there are two distinct kinds commonly found in Australia, are so well known, and have been so frequently figured and described, that it will not be necessary to give very detailed or technical descriptions of them here. A considerable number of inquiries have been received during the past two years regarding these destructive moths, chiefly from amateur bee-keepers; and it may, therefore, be useful to publish a few notes concerning the habits and seasonal appearance of these insects in Australia, more especially as I am able to add some information regarding remedial and preventive measures for the suppression of the pests which have been found satisfactory by experienced bee-keepers. The larger of the bees-wax moths—properly known as *Galleria mellonella*, Linn., but sometimes called by the name *Galleria cereana*, Fabr.—appears to be by far the most destructive of the two insects. It is a very widely-distributed species, being found throughout Europe and North America, in India, and even in the cold regions of Northern Siberia; indeed, it appears to have a range that is co-extensive with that of the hive-bee itself. In warm countries it is much more abundant, and therefore destructive, than in temperate or cold climates, a fact which is probably accounted for by the varying number of broods or generations which occur in a season under different climatic conditions. With us in New South Wales the first brood of moths appears in the early spring from caterpillars which have passed the winter in a semi-dormant condition, within the walls of their silken coverings, and only turned to pupæ or chrysalids upon the approach of warm weather. These winter or hybernating caterpillars feed very little, and usually confine their wanderings to the silken channels which they have made for themselves before the cool weather sets in. Upon the return of the desired warmth the caterpillars spin a complete cocoon for themselves and turn to the chrysalis stage, and in from ten days to a fortnight the perfect moth appears. The moth then lays eggs in any convenient spot, such as the sides and bottom of the frames, on the walls of the hive itself, or on the comb. In each case I have had an opportunity of observing the process, the moth chose the sides of the frames, as near to the brood-comb as possible, the young larvæ having a decided preference for this comb. The larvæ having once made their appearance, which they usually do in from eight to ten days after the laying of the eggs, their growth is exceedingly rapid, the average time before they are ready to assume the chrysalis stage being only some thirty days. The average duration of the chrysalis period is about a fortnight, so it can easily be seen with what great capabilities for

rapid reproduction we have to deal. As we have said, the number of generations, or broods, which develop in a season, *i.e.*, between early spring and late autumn, varies with locality and climate, but it may be worth while to record that, in my opinion, we have sufficient evidence to prove the existence of four broods in the Sydney district under ordinary circumstances. I have myself successfully bred three generations or broods from a comb received in early spring from the Richmond River; and I am convinced that a fourth might have been bred from the same stock but for an unfortunate accident to the eggs obtained from my third brood. Upon first hatching, the larva is pale yellow in colour, with a slightly-darkened head; and when full grown, is of a dull greyish flesh colour, with a dark reddish-brown head. Its average length is about an inch, and like the majority of the caterpillars of moths, it has sixteen legs. The chrysalis of the larger bees-wax moth is of the ordinary type, and it is enclosed in a very compact cocoon of tough white silk, usually spun up in one of the silken channels or galleries made by the larva which we have previously referred to. The perfect insect or moth has reddish brown-grey forewings, which are distinctly lighter in colour towards the outer or hinder margins. The sexes may readily be distinguished by the outline of the wings, as will readily be seen by a glance at the plate accompanying this article.

The second species of bees-wax moth is known as *Achrœa grisella*, Fabr., the lesser bees-wax moth, or honey moth, &c. Although not nearly so destructive as the larger kind, it does considerable damage in old and neglected hives. The moth is much smaller than *Galleria mellonella*, with which, by the way, I have found it associated in the same hive on more than one occasion. It is of a dead grey colour, with a yellow head. This species is not nearly so particular in choosing its food as the former kind (*G. mellonella*), and may frequently be found feeding on the *débris* which commonly collects on the bottom of a neglected hive.

In an article by Mr. W. W. Smith, published in *The New Zealand Country Journal* (vol. XVIII, p. 13, 1894), the following observations occur, and we venture to quote them here, as they appear to give some valuable information regarding the remedies for the attacks of these moths. Mr. Smith says:—
"In suggesting means for the suppression of the pest (the lesser bees-wax moth), it is important, as already stated, to put swarms into sound boxes, and to fit them closely on their boards or staging. The entrance to the hive should not be made too large, but just sufficient to enable the bees to pass to and fro without overcrowding. These precautions lessen the chances of the moths gaining access to the hives. It is advisable not to put the swarms into too large boxes, as any vacant space in the hive enables the moths to fly about, and also lessens the chances of their destruction by the bees. Another important matter is to examine the boards occasionally, and should any caterpillars or chrysalis be found thereon to replace them with clean boards. These remarks apply only to ordinary bee-keeping in plain boxes, such as is practised about farm homesteads and in the gardens of artizans. Should the foregoing hints fail to keep the moth in check, I would suggest that any hives becoming badly infested with the pest be destroyed with sulphur, and, after straining the honey, to carefully burn every particle of the comb. In badly infested hives the comb becomes impure, and frequently smells strongly when the box is raised off the board. To be able to obtain a supply of pure honey in future, stringent measures should certainly be adopted at the present time to check the ravages of the honey moth. The use of bar hives, and carefully attending to them for a few seasons, would practically annihilate the pest. The interest, however, in bee-keeping is not

BEES'-WAX MOTHS.

(Galleria melonella and Achrœd grisella.)

so general as to expect this to be done by ordinary bee-keepers. It is, nevertheless, regrettable that this pest should be allowed to increase, when a little attention and care for a few seasons would exterminate it."

From the foregoing account of the habits of these moths it will be gathered that remedics are not difficult to find. They may be briefly summarised as follows :—

a. Cleanliness; and to attain this frame-hives are essential. Every larva and every cocoon must be destroyed when found. Mr. W. Abram, an excellent local authority on bee-keeping, says, "Take out every comb and give the frames a gentle tapping with a small stick, when every grub will hasten to get out of its hiding place as quickly as possible, and will drop off, when it may be killed. Now with a knife, or other pointed instrument, pull out the cocoons, clean everything, and replace the frames."

b. Stored combs must be closely watched, and, if found to be infested, fumigated with sulphur.

c. Lantern traps, such as are ordinarily used by moth-collectors, have been recommended for trapping the perfect moths, but I doubt if they are worth the trouble which they entail.

It is a well-known fact that the beeswax moths do not attack the Italian or Ligurian bee to any serious extent; indeed they are rarely attacked at all. It is the ordinary black bee or hive bee that suffers so greatly.

In conclusion, I would express my thanks, amongst other kind correspondents, to Dr. Dagnell Clark, the Rev. John Ayling, and Messrs. Abram and Riddel, who have been kind enough to forward to the Department specimens or information.

As far as I am aware very few recognisable figures of the bee-moths have been published, so that the plate attached, from the pencil of Mr. E. M. Grosse, will, doubtless, prove very acceptable. With the exception of an excellent wood-cut in Dr. Taschenberg's "Die Insecten" (Brehm's Thierleben, vol. IX, p. 432) of the larger species, I have not been able to find a figure showing the stages or habits of these moths.

EXPLANATION OF PLATE.

Bees-wax Moths.

Fig. 1.—Larva or caterpillar of Larger Bees-wax Moth (*Galleria mellonella*, Linn.), side view (much enlarged).
,, 2.—The same viewed from above (much enlarged).
,, 3.—Cocoon of same, extracted from bee-comb (enlarged).
,, 4.—Larger Bees-wax Moth (*Galleria mellonella*, Linn.), male (much enlarged).
,, 5.—Forewing of same, female.
,, 6.—Larva or caterpillar of Lesser Bees-wax Moth (*Achrœa grisella*, Fabr.), side view (much enlarged).
,, 7. Pupa or chrysalis of same (much enlarged).
,, 8.—Lesser Bees-wax Moth (*Achrœa grisella*, Fabr.) (much enlarged).

In the back ground, above, a comb from a frame-hive is represented, showing brood-comb tunnelled by the larvæ of the Larger Bees-wax Moth (*Galleria mellonella*, Linn.)

The natural sizes of the insects are indicated by hair-line.

Report on Investigation of Bee Diseases at Campbelltown*.

BY R. HELMS,
Department of Agriculture.

Sir, W. S. Campbell, Esq., Department of Agriculture.

I beg to hand you the accompanying report concerning the be diseases, the investigation of which I had the honor to be entrusted with.

Whilst, I may say, that my experiments have produced a fairly satisfactor result, I must at the same time submit that upon several points my con clusions may not prove permanently tenable, because they are to a grea extent speculation and deduction. This is due to the uncertainty which stil exists about the origin and cause of at least one of the diseases, and wil require a thorough scientific investigation before a definite conclusion can b arrived at.

The time at my disposal necessary for the experiments was scarcel sufficient, considering that they had to be carried out with caution on accou of the lack of knowledge regarding the cause of the diseases. And beside that, it must be taken into consideration that bees cannot at all times b handled to advantage either to the operator or, more particularly, to that o the bees themselves. Cold, damp, and windy weather, or even an overcas sky will often make these insects very irate, and fighting and robbing may b encouraged if they are sprayed under such unfavourable conditions; or th temperature of the hive may be reduced by the operation so that the welfar of the brood may be endangered. Unfortunately frequent changes o weather impeded me to a great extent; and being well aware that unde different conditions probably quite different results may be the outcome o certain experiments, I must not omit again to point out that, although m experiments have proved successful, further investigations are still necessar and may lead to yet better and more decided results.

The anxiety of many bee-keepers to ascertain the outcome of the experi- ments induced me to report at the present time as fully as I am able, but i laying my observations before you, I am respectfully requesting you t consider the same by no means as finally completed, but merely as a goo step forward towards the proper handling of the trouble.

I have, &c.,

Sydney, 13th February, 1894. R. HELMS.

* NOTE.—In a communication addressed to the Department, Mr. Kitching of Campbell town, at whose apiary the above experiments were carried out, states that as a result o Mr. Helms' efforts the diseases have been completely stamped out.—ED.

BEE DISEASES.

Bee Paralysis.

Description.—The premonitory symptoms, if there are such, of this disease are imperceptible to the human eye. As a rule, it is only recognised when it has already reached an advanced stage. At this time a considerable distension of the abdominal parts of the bee takes place. The rings and plates become separated, so to say, and the intervening membranes are often stretched to such an extent that the movement of the joints becomes impossible, and the whole part below the constriction of the body appears as if ready to burst. The insect has now lost the power of using its limbs in the normal manner and staggers slowly about with generally one or both hind legs dragging, and at times rolls over,—as if drunk. Attempts to fly become futile, and result in short misdirected rises and frequently in a tumble only, but mostly the nervous vibrations of the wings are entirely powerless to lift the bee from the ground. The entire loss of power to use the sting is characteristic, and a still more advanced stage of the disease manifests itself by the increasing loss of command over the limbs; the front legs as a rule remaining active the longest. Ultimately the insect falls over, and, after a few hours, dies. No doubt the temperature considerably influences the protraction or acceleration of the death, but generally for an hour or two after the bee has fallen over the intermittent twitchings of the bag and wing muscles still indicate that life is not quite extinct. Almost invariably the bees die with their tongue protruding full length.

The intestines of the swollen bees are filled with a yellowish green liquid mass of fæcas, containing a good deal of pollen, which seems to a great extent to be the origin of its colour. Its odour is acrid and unpleasant, resembling the smell of cat's urine. Large numbers of various kinds of micro-organisms can at all times be found in this fluid mass, some of which are also found in the blood and in almost every part of the body.

The old bees as a rule suffer more severely from the disease, and those that succumb to it are found to be principally foragers; but I have also seen quite young bees, and even such as have only just been hatched, die off. This, however, I noticed more particularly to be the case in very reduced colonies.

Probably the development of the disease may extend over a considerable time before if becomes so virulent that it can easily be detected by the human eye; but whenever it approaches that stage it ends fatally to the bee within three days.

The Depilating Disease.

Description.—The bees suffering from this disease are easily recognisable by their appearance, as they become glossy and almost greasy-looking when it advances. This and their somewhat reduced size at once distinguishes them from the other bees of the colony. The gloss is due to the loss of the hair of the abdomen, as well as that of the thorax; but the abdominal parts seem to lose the hair first. Most likely the disease is the primary cause of the hair coming out, but it is doubtless promoted through the rubbing the bees get in the hive, and during the tussle they are subjected to during their ejection from the hive and afterwards. The glossy appearance may however to some extent also be attributable to a secretion of a fatty substance or moisture, because it often looks as if the sick bees were perspiring. When seen in

the hive they generally crawl slowly about the frames and at the bottom of it. They evidently have become too languid to fly out for the purpose of gathering food, and live upon the stored supply of the community. This behaviour is resented by the other bees, and consequently the sluggards are driven out; but probably many, feeling their death approaching, leave the hive on their own accord.

In front of the hive of a diseased swarm a number of hairless bees may always be found loitering on the alighting board when they are very often vigorously attacked by the healthy bees. These tumble over and over with them, and drive them away from the entrance. Occasionally two attack the same diseased bee, but generally only one takes the office of removal. A considerable number are carried away on the wing to a great distance from the hive, and probably not dropped till the carrying bee becomes tired. I have followed some of these pairs with my eyes to a distance of over 200 yards, and could never see the diseased bee being dropped. Dead specimens are also carried away to a large extent, which is not a very difficult task, as the dead soon dry and become light; a great number however remain lying about the hive when the death rate is large. I have noticed frequently diseased bees flying away, but I never saw one coming to the hive laden with pollen or honey.

During the warm time of the day a constant turmoil is noticed in front of the hive of a badly diseased stock, which, at first sight, resembles robbing to a great extent, more particularly so, because two apparently different kinds of bees are engaged in the contest. The shining appearance of the one kind, however, is a sure indication that diseased bees are expunged, and that no foreign agression is contested. Moreover, on close observation it will soon be noticed that the shiny bees behave differently to robbers, which as a rule attempt to enter the hive by stealth, and in all sorts of ways and openings beside the common entrance. At times the diseased bees are allowed to crawl about unmolested on the alighting board, and may re-enter the hive, but as a rule they either voluntarily soon come out, or they are pushed out again.

The most remarkable thing I noticed is that frequently a diseased bee is fed by another, just as if induced to do so by sympathy, a feature quite foreign to the general desire of the community to expunge the diseased and useless members. I noticed also that a number of bees encircled a diseased one, and very actively nibbled about at its body and limbs in a caressive manner, agitating at the same time around it. The exact motive of this behaviour I cannot understand, but it appeared almost as if the bees removed something from the body of the diseased one. The process seemed to be agreeable to all engaged in it.

In my opinion this disease is due to *Bacillus gaytoni*, Cheshire, with which the microscopical preparations I have lately made fairly well agree, but a further investigation is necessary to fully establish this fact by more extensive experiments, and by means of cultures, &c., which, however, cannot well be gone into until Dr. Cobb's laboratory is refitted.

Whilst the most of the hairless bees appear considerably reduced in size, I have seen occasionally some specimens with a dilated abdomen, which, because bee paralysis existed in the apiary, may be due to the probability that they were attacked by both diseases. In several instances I noticed both diseases to occur in the same hive, and at one time inclined to the opinion that possibly both were the same under different forms of development. However, from this opinion I have departed since I have more closely observed the progress of both.

The bees nearing death, after having crawled about in an aimless manner for some time, fall over and lie on their side. They die soon, but a twitching of the legs and antennae continues for a little time after they have fallen. When quite dead their tongue protrudes, generally full length, and the abdomen is bent forward; the last feature gives them the appearance of having been stung.

The Diseases possibly Contagious.

Considering the character of them and their development it appears to me that both diseases are due to some bacillus or other micro-organism, and presuming this opinion to be correct, it can hardly be doubted that they are contagious as well as infectious. This seems to me proved by the spreading of the diseases, for, as a rule, when they once make their appearance in an apiary, and are not immediately checked, they run from one colony to another, and often through the whole stand. That it may also be spread by the queen, in my opinion, is very probable, because I know of cases where the disease first appeared in a colony that received an imported queen, and where, prior to this event, nothing of either form of the disease had been noticed. In two of these cases the queens came from apiaries that were affected with one or the other of the diseases.

Some colonies, however, escaped the infection of the diseases, and therefore may be considered as enjoying immunity from them. This is very important, and in all of such cases I noticed that these colonies were populous, and possessed a vigorous queen. Weak colonies, on the contrary, seem generally more readily attacked or suffer more or less from them. Two reasons may account for this: either the stock is composed of naturally weakly bees, that possess little resisting power, or the hive is visited by robbers that, though perhaps not infected themselves with any disease, may bring the contagion from other colonies, and frequently reinfect the numerically—and likely constitutionally as well—weak colony.

Prevention and Cure of Diseases.

A prolific queen, which, as a rule, produces a vigorous progeny, seems to me one of the most important factors in the regeneration of a diseased colony, and the best means of resisting the ravages of diseases, as well as the leading preventive of their recurrence. This theory has already been proved to be correct by practical experiments. A particularly striking instance I will quote. One of Mr. Kitching's colonies was very badly affected at the time I began my experiments at his apiary, but its queen had been superseded some time previous to my arrival. This queen proved to be very prolific, and as soon as her progeny began to populate the hive the treatment I had in the meantime subjected the bees to produced a strikingly beneficial effect, which I must attribute greatly to the assistance rendered by the general vigour that was beginning to pervade the stock from that time. Although this is the most pronounced, it is not the only instance where the beneficial influence of a vigorous queen was observable.

An abundant honey-flow, it has been observed, greatly helps to reduce the mortality, and consequently assists in the elimination of the disease. Besides, to a healthy nourishment I am inclined to ascribe this beneficial effect to the greater activity displayed by the bees during the honey-gathering flights, because it seems to me that a honey-flow has more effect than mere feeding, and, therefore, it cannot well be attributed solely to the more copious supply of food. However, the colonies that are badly supplied with food suffer

undoubtedly more than those that have a sufficiency. Feeding, therefore, should not be neglected whenever the necessary quantity of honey becomes exhausted in a hive, for it stands to reason that a starved colony will succumb to the attack of diseases at once. A thin food that would require shifting from the cells again after first storing seems in my opinion, the most suitable, but whether such should be honey-food or sugar-food, I am not in a position to decide at present. Probably sugar-food would be the more suitable, because the sugar-syrup resembles the natural nectar, and a desirable physical action may be produced by it.*

To eradicate the diseases, I conducted my experiments on the presumption that they are contagious, and therefore originated by some form or forms of micro-organisms. No necessity exists to deal with such experiments that proved ineffective or too tedious. I will, therefore, content myself with those methods that, in my opinion, are necessary to be followed, and which at the same time are the most promising to ensure a speedy cure.

A complete disinfection of the stand of the apiary, as well as of the hives, is a primary condition. If the hives are placed upon the ground a careful chipping out of all the grass and weeds is necessary, which, after they have become dry, should be burned on the ground where they lie. To secure a thorough consumption of the weeds, and a total destruction of the spores that may infest the surface of the ground, it is advisable to strew some readily inflammable material over the area of apiary, such as straw or shavings, to insure a heating of the soil. (It is scarcely necessary to say that the burning of the ground must be done after dark, when the hives may easily be removed without disturbing the bees.) I found it convenient to drag a lighted mob of tow or cotton waste, saturated with kerosene, over the ground, and in this way secured a good ignition of the loose material, and by stirring and leaving a burning flock here and there in places, accomplished the destruction of the roots and stalks where these were lying heaped up, or may be, covered with soil. After disinfecting the ground in this manner it is advisable to rake it and roll it firm before the hives are replaced, because on a firm ground the dying and dead bees may easily be seen and more readily removed.

The safest method of disinfecting the hives is also by heat. Boiling water answers best for this purpose. An immersion for five minutes is necessary, and it must be observed that the water requires to boil during this time, and if much wax and propolis is adhering to the box it is advisable to remove those first. In the case of bee-paralysis, I advise the delay of the disinfection of the ground and hives till after the bees have been purged, for the obvious reason that the excreta most likely contain a large amount of contagious matter, a great deal of which would probably be deposited within the area of the apiary and pollute the ground.

Treating for bee-paralysis I recommend the following method :—Purge the bees; transfer them to a disinfected hive; spray them and the combs with a solution of carbolic acid of half per cent. strength, and repeat this spraying every third or fourth day till the cure is achieved. Occasional feeding with salicylated honey or sugar may also be advisable, which will depend upon circumstances, and must be left to the discretion of the apiarist.

* NOTE.—I am well aware that the moving of honey from cell to cell, for the purpose of drying it, is disputed by many, and doubted by most apiarists; perhaps justly so. Probably it is only done when the bees are not busy with a copious flow, if at all. However, for their consumption they use the fresh honey in preference to the drier or ripe, and, therefore, the thinner a mixture the more likely it will be used first, which serves my argument as well.

To make the bees take the medicated honey in such quantities as is necessary to produce the desired effect, and just about no more than is sufficient, is at all times beset with difficulties. There are various methods of giving food, but in order to allow as many bees of a colony to get at it at the same time in the case of purging them, a frame, covered with finely perforated zinc, that fits the hive, answers the purpose best. The food in this way may be spread over a large surface, and becomes simultaneously available to a great number of bees. Giving the medicated food at night, I closed the hive for sixteen to eighteen hours, and then let the bees go. Finding that oil of cinnamon produced an exiting effect upon the bees, it is advisable to spray them with it in a diluted form—about 20 drops to a ½ pint of luke-warm water and well shaken—when they are about to be liberated. This will start them to flight, which assists them to void freely. A difficulty of voiding exists when the disease is progressing towards an advanced stage, and this must be overcome by judicious purging and a stimulation to activity. If the difficulty of voiding is overcome, almost prostrate individuals will regain the power of flight. This I observed first with bees I was keeping some time ago under a glass globe for the purpose of making microscopical preparations of them, as well as for the study of the progress of the disease. When the air under the globe became hot through the sun shining upon it, some of the almost dead specimens rallied and became agitated when the heat increased. The consequence was that some of them voided profusely, and then regained the power of flight. Several I allowed to escape through the windows, and saw them fly away apparently as if nothing ailed them. For the "Depilating Disease" the purging may be dispensed with, although it may act probably beneficially in this case as well, but it is not so necessary as in the case of paralysis. The spraying with carbolic every third or fourth day is, however, necessary, and an occasional feeding with salicylated honey is recommended.

During my experiments I found that bees can endure considerably stronger medicines than their small bodies would lead one to suppose, and were it not that the welfare of the larvæ might be impaired, probably very drastic doses might be applied. I have, for instance, very copiously sprayed with a 3 per cent. mixture of formic acid, which did not in the least inconvenience the bees, in fact, in most instances, they greedily drank the globules of it. This 3 per cent. mixture of formic acid undoubtedly greatly improved the condition of the bees, but the ½ per cent. carbolic spray I found the most effective, and, therefore, I recommend it at present for general use.

Besides these applications of medicine, and the general disinfecting of the apiary, there may probably be other very important agencies instrumental in bringing about a cure in either disease, which I think deserve careful consideration. These consist in the renovation of the affected colonies by a more vigorous strain of bees, which can only be brought about by superseding the queen by a young prolific one that has been produced by a healthy colony; more advantageously still by one that has been reared by bees that reasonably may be supposed to enjoy immunity from the attacks of these diseases. This has been already alluded to above, but on account of the importance attaching to it, I deem the reiteration of the subject allowable. Generally before the diseases disappear they seemingly fluctuate in virulence, that is to say the death-rate of bees vanishes by degrees, and then all at once it increases again. This seems to me explainable from the probability that from yet unknown causes during certain periods a more rapid development of the contagion takes place than at others, or that at times the brood is more vigorous and physically superior and contagious-resisting than at others. From this it follows that when the diverse hatchings approach their natural

decay from senility, this is accelerated by the attacks from the disease, and the death-rate becomes more apparent again from the increasing numbers that lie about the front of the hive. Such vexatious increases of the death-rate, however, become less perceptible, or disappear altogether when the new generations springing from a vigorous queen become the numerically predominating inhabitants of the hive. This seems to me an almost complete proof that the greater vigour of the bees is a powerful factor towards the elimination of diseases, and I have no doubt that such a colony, when assisted by rational treatment, will soon become healthy again. Queens reared by healthy and prolific colonies, it appears to me, are therefore of the utmost importance, and their fertilisation by healthy drones coming from a vigorous stock is equally essential. To prevent the fertilisation of queens by diseased or weakened drones, for which a chance exists, although the most vigorous drone always has an advantage, those found in diseased hives ought to be destroyed. Neither the drones nor the queens, although they resist the diseases under consideration to a large extent, I find enjoy complete immunity from them, but if not actually succumbing to the attacks, it is reasonable to conclude that they will produce a weakly progeny, which is a danger in itself.

Regarding my opinion of the importance of superseding the queens in attacked colonies, I am thoroughly in touch with many bee-keepers whom I have conversed with on this subject. For instance, Mr. T. H. Bradley, of Sunnyside Apiary, Appin, a noted and experienced bee-keeper, fully agrees with me, and even goes so far as to almost entirely deny the efficacy of treating the bees with medicines, and thinks the remedy lies solely in the production of physically superior queens. A letter from him, fully discussing this subject, I attach to this report, as no doubt it is pregnant with suggestions of vital importance to the future of the apiculture of New South Wales. I cannot but help agreeing with Mr. Bradley that the excessively practised methods of artificial queen rearing has probably to a great extent been conducive to the physical degeneration, as appears to be the case with some strains of the present bee-races. It is my unqualified opinion that a strong and prolific queen can only be produced when abundance of food is supplied to the larva by young bees, which is the order of nature, and which must not be lost sight of whatever means may be adopted for the purpose of artificially superseding natural queen breeding.

Summarising the methods I recommend for curing the bee-diseases known as Bee-paralysis and Depilating Disease,* they are, in short, as follows:—

Disinfect the stand and hives by heat; in case of Bee-paralysis give a purgative, and keep the bees closed up for fourteen to eighteen hours, and then start them from the hive, and excite them by spraying with diluted oil of cinnamon; spray in either case with ½ per cent. solution of carbolic acid every third or fourth day; supersede the queen of the diseased colonies in both cases as soon as possible by a prolific queen from a healthy strain. As a good honey flow has been observed to help very materially to eradicate diseases, I would recommend feeding in every case where either of the diseases have appeared in a stock in which the supply of food is reduced. It may not act quite as effectively as the gathering of nectar, for which a greater amount of exercise is necessary, and the activity displayed by the bees during this process seems certainly conducive to keeping the bees in good

* This is more generally known as the "hairless" disease, which, however, sounds so irrational that I cannot, on account of this, adopt the name. It is not the disease that is hairless, but the bees become hairless during its progress.

health, but it is the best substitute for it, and will keep the individual inhabitants of the hive strong, and consequently better adapted to resist the aggression of contagion. Moreover, the food thus given can be judiciously medicated with antiseptics, which would be desirable, if not actually necessary.

Regarding the purgatives given by me, I found that podophyllum or senna acted very beneficially without producing any apparent weakening effect; of the two, podophyllum seemed to me preferable. The doses given were: 1 fluid oz.* of tincture of podophyllum to 6 lb. of honey-food; or 4 fluid oz. of tincture of senna to 6 lb. of honey-food, the honey-food to consist of three parts of honey and one part of water, to be well boiled and skimmed. A little extra water has to be added to allow for evaporation during the boiling, the medicine to be added after the food has become cool. Three-quarters of a pound to a pound, according to the strength of the colony, or less if the same is weak, spread over a perforated sheet of zinc, as described before, is about the quantity to be given, but as the number of bees in each hive is often very variable a hard and fast rule cannot be laid down for it. As in many other cases, the administration of the medicine and the general treatment must be left to the judgment of the apiarist, who will know best how to choose a suitable time for it, and who is generally fairly well acquainted with the strength of his colonies.†

I have not tried Epsom salts, but have heard of it being administered with good results. No doubt it will purge readily, and a 1 oz. packet to 10 lb. of food would produce a strong medicine. A somewhat drastic method of purging seems to be necessary to cure Bee-paralysis, but the absence of all stimulating action in Epsom salt induced me to reject it.

McLain's mixture, which has often been applied, can only be regarded as a purgative, because the antiseptic properties of the small quantity of Salicylic acid it contains is entirely destroyed by the neutralising action of the bicarbonate of soda.‡ The bicarbonate of soda, moreover, may act depressingly upon the bee, as it does upon men, and, therefore, this mixture ought to be rejected, because there can be little doubt but that bees suffering from bee-paralysis, whatever its origin may be, require a stimulant rather than a sedative. The salt is evidently the best part of the mixture.

It is well known that salt is required by bees, particularly in spring before any honey flow sets in, and probably acts as a mild purgative upon their constitution. At any rate, it seems to be a tonic, so to say, and therefore it must be recommended to be given at times to the bees, so that they do not require to seek it at offensive places, such as dung-heaps, urinals, or the overflow of closets. It is very desirable that a few small wooden troughs filled with brine, or where the atmosphere is not too dry, a few pieces of rocksalt be kept at every apiary, to enable the bees to get the necessary supply readily and in a clean manner when they feel inclined for it.

To obviate the offensive smell carbolic acid possesses to bees, I mixed the ½ per cent. solution with some oil of thyme. The odour of this, it is well known, is very agreeable to bees, and a dozen to twenty drops of it to a pint of mixture scent it perfectly, and apparently suppress the smell of the

* I found that an ordinary egg-cup holds as near as possible a fluid ounce, and may safely be used in case a graduated vessel is not available.

† Dr. Cobb advised that to 10 lb. of food, 1 oz. podophyllum, or 4 oz. senna be mixed, but I found this quantity not effective enough.

‡ As a cure of foul brood, for which this mixture was originally recommended, its efficacy, therefore, may justly be doubted, as well as its power of destroying other bacilli.

carbolic. Besides the agreeable smell, the oil of thyme possesses antiseptic properties, and, therefore, acts beneficially at the same time. Formic acid I consider very beneficial, and on account of its being the naturally used antiseptic of the bees I experimented with it very hopefully. The result, however, did not come up to my expectation, because the effective action did not appear very readily. Comparing it with the action of carbolic I consider it slow, but it certainly acts very beneficially, and is very agreeable to the bees. It is quite possible, however, that under different conditions the chemicals may prove to act considerably different, and that quite a reverse result may be attained in regard to the application of the different antiseptics. Possibly a stronger than a 3 per cent. mixture of formic acid may be used to advantage, but a weaker one is certainly too slow in its action. The small supply at my disposal prevented me from prolonging my experiments with this acid.*

Salicylic acid sprays I have also found acting too slowly, owing, no doubt, to the fact that the strength of a mixture at ordinary temperature cannot be made to exceed ·2 per cent. That is to say, a cold water solution is saturated with $\frac{1}{5}$ per cent. of salicylic acid. If a warm solution is used the excess of the salicylic acid crystalises out as soon as it becomes cold, and in passing through the fine orifice of an atomiser, whilst spraying, chokes it and interrupts the work. I found that if a plain angular tube atomiser that is blown by the mouth is employed, warm surcharged solutions may be used, because the orifice of these sprayers is much larger and does not readily block. On account of this, these atomisers are perhaps the most recommendable for salicylic sprays. The salicylic acid being odourless, is certainly more agreeable to bees than carbolic, and if it can be used strong enough ought to act as effectively. It is, however, to be noted that salicylic acid must not be used in connection with any alkalines, because these destroy its disinfecting properties by neutralising the acidity. The apparent greater solubility of the salicylic acid, if mixed with alkalines, occurs simply through the splitting up of its component parts by the reaction. Worse still is the mixture of it with permanganate of potassium, because the reaction set up by this chemical produces a complete decomposition and oxidation by which the disinfecting properties of both the salicylic acid and the permanganate of potassium are destroyed.

Honey as well as sugar are better solvents of salicylic acid than water, and in consequence of this a strength of $\frac{1}{2}$ per cent. may readily be produced, but not much stronger. To obtain this 1 oz. (by weight) of salicylic crystals to 12 lb. of food, consisting of three parts honey and one part water, or two parts sugar and one part water (and in each case a little water added to allow for evaporation) will produce a mixture slightly above $\frac{1}{2}$ per cent. The salicylic should be added after the food has been skimmed, and then be allowed to boil for a few minutes whilst the mixture is stirred. As in the case of spraying, only salicylic acid should be added to the food, and not borax as well, as recommended in some prescriptions, because the borax is likely to cause a neutralising reaction, and so destroy the efficacy of the salicylic acid.

* Formic acid seems not to be much used in medicine, and, therefore, is rarely obtainable in Sydney. The only 2 lb. I could obtain were, moreover, so terribly diluted, that upon tests made by the chemist of the department, Mr. F. B. Guthrie—to whom I must express my thanks for his valuable assistance on this, as well as other occasions—one sample proved to be 13 per cent., and the other 9 per cent. Such a low percentage can only be due to dilution, because the simply-distilled material produces 55 per cent. of formic acid. This shows how untrustworthy some chemicals are at present found in the Sydney market.

A few more hints for the prevention and the spread of diseases deserve attention. All bees lying about the hives should be removed daily and burnt. Ants I have noticed to carry dead bees to their burrows or under the hives and into crannies. This would undoubtedly tend to encourage reinfection, and therefore ought to be prevented. Dusting the ground of the apiary around and under the hives from time to time with flower of sulphur would be very advisable to keep it pure after the disinfection by fire. It is very questionable whether the wax for foundations is sufficiently heated to destroy baccili, and consequently in taking it from diseased colonies for this purpose may lie a danger of spreading diseases; it is therefore advisable to be careful, and to use only such foundations which are prepared from wax of healthy colonies. Robbing must be carefully suppressed.

From all accounts the honey flow has been very poor this year, and unless it soon alters for the better it is likely that most of the apiarists will find their stocks not so populous at the beginning of winter as they would wish, and after the natural dwindling next spring must expect them to be reduced below the average. If, therefore, diseases were to break out with increased force after next winter, and this should fall together with unfavourable spring weather, enormous losses may occur to bee culture. To prevent these as much as possible, I strongly advise every apiarist that he should take the utmost precaution to provide against excessive losses by a careful "wintering" of his bees. This should include, where the least sign of disease has been making its appearance, the transferring of the frames to a clean disinfected hive and the spraying of combs and bees with a disinfectant, and under any condition a provision for sufficient food and for the general comfort of the bees.

With the present knowledge of the bee diseases I am not able to offer better advice than that which is given in the foregoing, and I feel that many apiarists will object to the somewhat tedious and laborious process of it, and no doubt will wish for a much simpler and less time-robbing method. I am afraid that this will not be very readily found, and therefore preventions cannot be too highly recommended, together with judicious feeding, as soon as it becomes necessary to ensure by natural vigour an increased resisting power against diseases. Vigilance to discover the diseases before they have spread is of paramount importance. Considering the great amount of labour and anxiety that is attached to the treatment of an extensive apiary, I would advise that in a case where a single colony only is attacked in the onset, to destroy this entirely rather than risk the spreading of any disease by contagion. Unfortunately it occurs but rarely that a single colony or a small number only is attacked. In most cases brought under my notice the diseases appeared like an epidemic, and went through a great number of colonies. Great judgment must therefore be exercised whenever the extreme expediency of destroying a colony is resorted to.

Appendix.

Mr. T. H. Bradley's letter, referred to in the above report, is as follows:—

Sunnyside Apiary, Appin, 22 January, 1894.

R. Helms, Esq., Agricultural Department, Sydney,—

Dear Sir,—In reference to our conversation at Mr. Kitching's, Campbelltown, on the afternoon of the 18th instant, relative to the treatment of bee paralysis, permit me to state that while I am fully prepared to admit the importance of your mission to Campbelltown, I am not at all ready to acknowledge that the use of chemicals or drugs will stamp out the disease that has caused such ravages amongst us. To do that we must go to the root of the evil from which the bee-keepers of New South Wales have, I

think, to a great extent only themselves to blame. In my opinion this lies in defective queen-breeding. Apiculture has made enormous strides within the last few years, and largely added to its devotees. With this increase has come the increase of death and disease amongst the bees. After a few weeks' or months' work among bees, the novice arrives at the conclusion that he "knows all about bee-keeping," and "can raise queens as well as the most experienced bee-keeper in the land." To him a queen is a queen—the mother of the colony, but her fitness to fill this important position is altogether a matter of minor consideration. The second year of his novitiate usually finds him advertising himself as a queen-breeder—a specialist in fact. On inquiring into his system of breeding, it will be found that "it is the easiest thing in life; simply take the queen from a strong colony, and you have in a few days as many young queens as you can use." In a recent issue of a well-known bee paper this system was openly advocated by one writer, and was not only allowed to pass uncriticised by the editor, but the author was subsequently alluded to as an experienced bee-keeper.

Natural swarming, or, in other words, "the survival of the fittest," the system instituted by the Great Creator, and pronounced by him to be "good," is getting to be old-fashioned, and death and disease are following in the footsteps of the new fashion. Nature's laws are persistently violated, and nature enters her protest in the form of disease and death.

With the advent of foreign races of bees came what is termed artificial queen-rearing. Art is always supposed to be able to improve nature, but in the matter of queen-rearing it is attempted to supercede her. As Doolittle, the great queen-breeder of America, so clearly points out, artificial queen-breeding can only be successful when conducted in accordance with nature's laws. It stands to reason, otherwise, that we shall have our bees so delicate in constitution that they will not be able to stand the attacks of bacteria. That the hardy race of bush bees are able to resist the bacilli of foul brood and paralysis I have very good testimony. For years past I have been making inquiries among old bush men and bee-keepers, and from their description of diseased combs found in trees and boxes, I have no doubt but that foul brood existed or was present in Appin forest more than twenty years ago. It was once found in a tree on the bank of a creek, but, although several other bee trees were felled in close vicinity to it that season, not a trace of the disease was found in any other tree. A bee-keeper with about 200 box hives noticed foul brood in five or six of his colonies. These swarms died out, but the disease did not spread. Let foul brood appear in five or six colonies in a modern apiary of about 200 hives, and allow it to go unchecked for a time, what would be the result?

If you will institute inquiries you will, I think, find that the box hive bee-keeper does not suffer so much from bee paralysis as his more scientific brother. For example, a neighbour of mine, a box bee-keeper, who has about the same number of swarms as Mr. Kitching has, told me he had lost one swarm from a disease, but did not regret them much, as "that swarm was never any good for work." On inquiring carefully, I found the disease was undoubtedly bee paralysis. None of his other colonies were affected. Here we have two apiaries in the same district, within 10 miles of each other, the one conducted on nature's plan, the other on scientific principles. The one suffers to the extent of about 5 per cent; the other, about 75 per cent. In the one, the disease died out with the swarm, although every facility was afforded for its propagation by robber bees. In the other, the aid of the chemist and entomologist was sought to prevent utter annihilation of the apiary.

I have carefully studied this subject, and have given it much thought, but did not intend giving my ideas publicity until I had thoroughly worked them out in my own apiary, but as you have asked my opinion on the origin and progress of bee paralysis, I give it to you. Summed up in a few words, I think it all lies in defective queen-breeding.

I am, &c.,

T. H. BRADLEY.

On the Choice and Use of Artificial Manure.

By F. B. GUTHRIE,
Departmental Chemist.

Crop Requirements.

In connection with the rational application of artificial manures, we have, as we have seen from the last paper, the following points to consider:—

1. What are the chemical requirements of the different crops?
2. In how far do our soils supply these requirements?
3. In what direction are they to be assisted by manure?

I do not propose to touch upon the question of tillage or of general farming operations, except in so far as they may produce chemical changes in the soil constituents. The action of the different manures will be regarded entirely from a chemical point of view as plant food.

In the first place, with regard to the requirements of the different cultivated crops. A very superficial observation is enough to show us that the food required by different plants must vary considerably. Plants vary enormously in character. Between the fruit of the different species there is an almost infinite variety. The nourishment that produces the sparse leafage of the cereals can obviously not be the same that is required for the leaf-masses of such crops as lucerne or cabbage. The differences are not in all cases so obvious, but we may safely say that every plant requires one or more special sort of food, and exercises a power of selection in regard to such food. Some crops cannot make use of the soil-ingredients to the same extent that others do. Some crops also occupy the ground for a longer period than others; those that come rapidly to maturity will require a larger store of food which is immediately available. Again, their requirements vary in many cases at different stages of their growth. What these special requirements are we will now proceed to examine more in detail for each class of crop.

Cereals.

Wheat.—The quantities of the different fertilizing ingredients removed from the soil are as follows:—These, and similar figures with regard to other crops, are taken from Warington's Chemistry, and refer to English conditions. If the figures here given as the average weight of the crop appear too large to our farmers, all I can say is that there is no reason why we should not produce crops of the same average weight. These crops were obtained by the proper and scientific application of manures on the lines I am advocating, and there is not the slightest reason to doubt that we can obtain the same results by the application of the same principles. A wheat-crop of 30 bushels grain to the acre weighs about 5,000 lb., or something over 2 tons of grain and straw, and removes from the soil during the period of its growth 48 lb. nitrogen, 21 lb. phosphoric acid, and 29 lb. potash. The

wheat crop depends practically entirely upon the soil for its nitrogen, so tha for the whole of the above quantities of food the wheat is dependent upo the supplies existing in the soil. Now, 48 lb. nitrogen is equivalent roughl to about ·003 per cent., as indicated by analysis in a soil of average weigh 6 inches deep. This quantity is very much less than the average percentag of nitrogen in our soils, which is quite ·1 per cent. That means that if th nitrogen in the soil were immediately available the poorest soil would contai abundance of it for a succession of several crops. But the wheat-crop doe not appear to be capable of utilizing the soil-nitrogen to its full extent, con sequently the application of soluble nitrogenous manures are particularl beneficial to it and the other cereal crops. The same remarks applies t phosphoric acid and potash.

Twenty-one pounds phosphoric acid represents about ·001 per cent. phos phoric acid in a soil of average weight and depth. This quantity is presen ten times over, even in poor soils, as is ·002 per cent. potash, the quantit represented by 29 lb. potash, required by the plant. If, then, it were possibl to convert the plant-food in the soil into an available form at the times tha the plant can make use of them the necessity for manuring of any sort woul be done away with.

One reason why introgenous manures are particularly beneficial lies in th fact that the period of the active growth of the wheat-plant ceases before th period when nitrification is most active. During the summer and earl autumn certain organisms are active within the soil, by the action of whic the soil-nitrogen is converted into nitrates.

Nitrates are exceedingly soluble salts, and particularly adapted for supply ing the wheat-crop with nitrogen, but their formation commences after th crop has ceased its active growth and they are washed away from the surfac soil before the succeeding crop can make use of them.

Wheat thrives best in soils of moderate stiffness, and does better in a mois soil than most cereals. In a moist climate it is said to do better on a ligh than on a heavy soil.

It is a usual practice to grow a root crop, especially turnips, before wheat During the growth of the turnip crop, nitrogen is stored up in the soil, an the roots tap more especially the lower strata of the soil. Lime is a essential ingredient in wheat lands, but the manures which are especiall beneficial are nitrogenous ones.

It is still an undecided question whether wheat absorbs its nitrogen i the form of ammonium salts or nitrates, but whilst the consensus of opinio points to the probability that it is in the form of ammonia that it actuall enters the plant, yet it is generally admitted that nitrate of soda is the mos effective form of manure. Sulphate of ammonia is, however, considerabl cheaper with us, and on that account will be our most effective fertiliser.

The cheapest method of applying nitrogen to the soil is by means of wha is known as green manuring. Leguminous crops, such as cow-pea or clove have the power of utilising the nitrogen present in the air in a manner w shall go into more fully later on. When such a crop is allowed to gro until its period of active growth ceases—that is, until it flowers, and the ploughed in, not only are all the fertilising ingredients which it ha abstracted from the soil returned to it, but the land is further enriched b an additional supply of nitrogen. The nitrogen in this form is not in suc a soluble condition as the nitrogen in sulphate of ammonia, but the metho is a cheap and effective one, and in cases where it can be convenientl applied, will be found of great value in improving the land, for, in additio to the direct supply of nitrogen, the decay of the crop within the soi

produces a store of humus, and exercises a solvent action upon the other soil-ingredients, hastening the natural decomposition of the soil, and benefiting it both chemically and mechanically.

The crops best suited for the purpose are such leguminous crops as mature quickly, and do not occupy the land for any length of time, and are otherwise of no great value as crops. I simply wish to draw attention briefly to the subject here, postponing a fuller discussion of the matter to a separate note.

Wheat occupies the ground for a very much longer period than other cereals, such as oats and barley, and removes rather a larger proportion of soil-constituents. It is, therefore, a somewhat exhausting crop.

The best manures for wheat in the soil of average quality is an autumn manuring of fine bone-dust and dried blood, about 3 cwt. per acre, followed by a top-dressing in the spring of a mixture of 2 cwt. superphosphate, and 1¼ cwt. sulphate of ammonia per acre; or instead about 3 cwt. per acre of a good phosphatic guano. This spring dressing it is best and most economical to apply in two portions, the first when the young plants begin to shoot, and the remainder at a somewhat later stage. If the above quantities are all applied at once a large proportion would not be immediately utilised, and would be washed away and lost. By applying it in two separate portions the fullest benefit is obtained.

Nitrogenous manure should not be applied at a late stage of the plant's growth.

On land rich in lime an autumn treatment of 2 cwt. superphosphate per acre is sometimes recommended instead of the bone-dust.

Do not use the nitrogenous manures in quantities much larger than those recommended above, as too much nitrogen is injurious, causing a tendency in the plants to become too green and to "lay," but mineral manures alone are not of much benefit unless a sufficiency of nitrogenous matter be added.

In no case is it intended that the manuring here suggested is to supplant farm-yard manuring. Where such is at hand or can be readily and cheaply obtained, let it be the staple manure. It is of permanent benefit to the soil. For some crops, however, it does not contain the particular ingredient which they require in sufficient quantity, whilst it contains other ingredients which they do not require, and which are consequently wasted. The chemical manures here in question are intended to supplement it where it is used.

Of the other cereals

Maize prefers light porous sandy loams, and does not do so well upon stiff clay soils. It is a gross feeder, and needs heavy manuring.

Rye accommodates itself to lighter and drier soils; in fact, the poorest soil is usually considered good enough for rye. The presence of lime is not of so much importance as with wheat.

Barley requires a light fertile soil, warm and friable, and grows most strongly, and produces the largest crops on land well tilled and heavily manured. If, however, the grain is grown for malting purposes, the application of nitrogenous manures is to be avoided, as the grain produced by such treatment contains a large proportion of nitrogenous matter, which injures the keeping qualities of the beer, the starch in the grain being likewise diminished.

Oats thrive best in a damp climate and moist soil, with a moderate summer temperature. They contain considerably more potash in the straw than the other cereals.

The manuring recommended in the case of wheat apply more or less to all the cereals. They are all especially benefited by the application of nitrogenous manures.

The autumn manuring may consist of farm-yard manure, dried blood and bone-dust or superphosphate, with a spring top-dressing of superphosphate and sulphate of ammonia, to be applied in two portions, as already indicated.

All soluble and concentrated chemical manures should first be mixed with about three times their weight of dry loam before they are applied to the land. This ensures their even distribution, and it is otherwise extremely difficult to avoid adding it in wasteful quantities in some places, and in too small quantities in others. It also prevents their accumulation about the seeds or roots, which they would be liable to damage. It further prevents their being blown away by the wind in dry windy weather, or their being too rapidly washed away in rain. In the case of a very light open soil this is especially necessary, and caution should be exercised in the use of soluble manure in such cases, as they are liable to be washed away before they have benefited the plant. As a rule slow-acting manures are the most applicable for autumn dressing; the soluble quick-acting manures being most beneficial at an early stage of the plants growth.

Grass.

A crop of 1½ tons meadow hay per acre contains on the average 49 lb. nitrogen, 51 lb. potash, and 12½ lb. phosphoric acid.

The question of the appropriate manuring of grass-lands is complicated by the question as to whether it is intended for permanent pasture or to be cut for hay, and whether grass or clover is to predominate. It may be stated generally that the proportion of clover is increased by the application of manures containing potash and phosphoric acid, and diminished by the application of nitrogenous manures.

Too heavy manuring of any kind, especially nitrogenous, tends to the growth of coarse grass. Manures containing lime such as plaster, also promote the growth of clovers.

For grass the best results were obtained by Lawes and Gilbert, by the application of mineral manures (superphosphate and kainit) together with sulphate of ammonia. Heavy grass-crops were obtained to the almost total exclusion of clover. To promote the growth of clovers, omit the ammonium salts from the above mixture, and manure with mineral fertilisers alone.

Stable-manure and compost is an excellent manure for grass-lands, especially when mixed with sulphate of ammonia.

Root-crops

Exhibit a greater variety in their food requirements than the cereals, and differ more amongst themselves. In all cases the crop contains a larger proportion of nitrogen than the cereals, but they appear to possess to a far greater degree than these the power of assimilating the nitrogen as it exists in the soil, consequently the application of nitrogenous manure alone is, as a rule, without much benefit. The exception being the mangel crop, for which purely nitrogenous manures are distinctly beneficial. They all produce far more bulky crops than the cereals, and remove proportionately larger quantities of the soil ingredients. They, therefore, require liberal manuring, and are especially benefited by the application of potash.

Potatoes.—A crop of 6 tons potatoes weighs about 18,000 lb. of tubers and haulm, and removes from the soil 67 lb. nitrogen, 80 lb. potash, and 24 lb. phosphoric acid. As in the case of the cereals these quantities are abundantly present in the poorest land, and it is only a question of the power of the crop to assimilate them.

Potatoes do well in most soils, best on loose mellow soils. Virgin soil appears particularly well adapted to their growth. This may be partly due to the manuring of potash the soil receives from the clearing and burning away of the timber. The sub-soil should be porous, the tubers are liable to rot in land with stiff sub-soil, or in very retentive soils. The soils should not be too stiff, otherwise there is not room for the roots to develop.

They are surface feeders, and, as might be expected from the preponderance of potash in their composition, the application of potash manures is especially beneficial. Kainit is a very valuable manure for the potato crop, and plays much the same part in regard to it that nitrogenous manures do in the case of cereals.

The addition of kainit alone is, however, not usually of much benefit, and it is usually applied together with superphosphate. Before sowing, the best treatment for average land is the following:—About 3 cwt. superphosphate, mixed with 2 cwt. kainit, and 1 cwt. sulphate of ammonia per acre.

The farmer will find it will repay him to buy these ingredients separately, and mix them himself, as by so doing he not only saves the cost of mixing but he can vary the proportions of the different ingredients to suit the requirements of his soil. In fact, in all cases where it is feasible, the farmer will generally find it more satisfactory to mix his own manures, particularly where the quantities are small enough to be mixed by hand.

Turnips.—A crop of 17 tons roots per acre contains 49,000 lb. of root and leaf, and removes from the soil 112 lb. nitrogen, 149 lb. potash, and 33 lb. phosphoric acid in round numbers.

They thrive best on light loams, loose and open. The land for the turnip-crop requires more thorough tillage and previous preparation than for any other crop, but this question is outside the scope of the present articles.

They are a crop that require heavy manuring, and a liberal dressing of farm-yard manure is essential to their successful cultivation. Though the quantity of potash is larger than in the potato crop, potash manures have not the same marked benefit. Their weak point appears to be their inability to make use of the phosphoric acid in the state in which it exists in the soil, hence the manures from which they derive especial benefit are those containing phosphoric acid, such as superphosphate or bone-dust. Three to 4 cwt. superphosphate per acre is the average proportion.

Mangels.—A mangel crop of 22 tons weighs 67,000 lb. roots and leaves, and removes 147 lb. nitrogen, 300 lb. potash, and 53 lb. phosphoric acid. Mangels are deep feeders, and require a deep and well-tilled soil. They form an exception to most root crops in that they are capable of utilising the phosphoric acid and potash present in the soil, and the manures that specially benefit them are those containing nitrogen. On a rich land, or one already well manured with farm-yard manure, the application of a soluble nitrogenous manure alone is of marked benefit, though, as a rule, it is added together with superphosphates.

Beet-root—Is also a crop that requires nitrogenous manures in conjunction with bone-dust or superphosphate.

Chemical Notes.

BY F. B. GUTHRIE,
Departmental Chemist.

Manufacture of Superphosphate.

THE following reply to a correspondent, asking for information as to the best method of preparing superphosphate on a small scale, may prove of service to those who would like to manufacture a small quantity for themselves.

It is advisable in the first instance to burn the bones and convert them into what is known as bone-ash, as fresh bones or bone-meal produce a slimy mass on treatment with acid which is exceedingly difficult to dry.

To prepare the superphosphate from bone-ash it is necessary to have a receptacle for mixing the ingredients which is not attacked by sulphuric acid. A wooden trough lined with lead (a sheet of lead hammered to fit the trough) is about the best; but the wooden trough, pitched inside, will answer the purpose, or a hole in the ground lined with cement. In this receptacle, the ingredients are mixed in the following proportions:—For every 40 lb. of bone-ash add 1 gallon of water and 15 lb. strong sulphuric acid (commercial oil of vitriol). Pour the whole of the water into the tank, then add *gradually*, stirring constantly with a wooden pole, the sulphuric acid. The acid combines very violently with the water, and unless it be added as directed above an explosion may result. Now add gradually, a little at a time, the bone-ash, stirring constantly with a stout pole or hoe. The above proportions should yield a mass possessing the consistence of a stiff dough. If it is not stiff enough some more bone-ash may be added. Leave it to itself for a few hours, when it will dry to a friable mass, easily broken, and in a fine state of division. Protect from rain whilst drying. The manure is now ready for use. Although burning the bones destroys the organic matter and diminishes the proportion of nitrogen, this loss is more than compensated for by the ease with which the product can be dried and handled. If fresh bones or bone-meal be used the fat which they contain prevents the complete action of the acid, and the resulting product is so slimy as to be unmanageable in many cases. If it is preferred to use fresh bones or meal, the following proportions are said to be the best:—

Dilute every ½ gallon of acid with 1 gallon of water, as directed above—that is, add the acid to the water, stirring all the time. Never on any account add water to the acid. Pour this diluted acid upon 20 lb. of the bone-meal in the trough, taking care to pour slowly, stirring all the while. The sticky mass must now be mixed with loam, wood-ashes, peat, or gypsum, in order to dry it. Instead of burning the bones the oil may be removed by steaming them, but this is rather a troublesome process. Simple boiling with water is better than nothing, though in no case is the product so satisfactory as that prepared from burnt bones.

Instead of using acid, bones may be rendered soluble by allowing them to ferment. The following is a good plan:—

Dig a trench and fill it with alternate layers of wood-ashes and bones, beginning and ending with wood-ashes. Moisten each layer of ashes when laid, and keep the whole moist by watering from time to time. In a few months the heap may be turned over.

Bones are also dissolved by placing them in a pit and drenching with a hot solution of lye, 1 lb. of potash lye to every 4 lb. of bones. Cover with earth, and stir occasionally for two or three weeks, when the mixture may be turned out to dry.

It will be seen that treatment with acid is the most rapid, and the product just as satisfactory, but caution is required in mixing the ingredients.

Analysis of Bone-dust.

The following is the composition of a bone-dust mixed with blood, forwarded for analysis by Messrs. Jules Rénard:—

Moisture...	= 8·21	per cent.	
Organic and volatile matter	= 58·82	,,	containing—nitrogen = 6·66; ammonia = 8·09.
Sand and insoluble matter	= 2·39	,,	
Tri-calcic phosphate ...	= 26·31	,,	(= 12·05 P_2O_5).
Other lime salts, calculated as carbonate ...	= 4·09	,,	

Mechanical condition.

Fine	=	26 per cent.
Medium	=	63 ,,
Coarse	=	11 ,,

This is a good bone-dust, containing blood and meat, the amount of nitrogen being particularly high. The product is in fair mechanical condition, and its manurial value, as calculated from the above analysis, is £5 15s. 9d. per ton.

Reports of Deaths of Sheep in various Districts.

THE following report on the above subject has been submitted by Mr. R. D. Jones, Acting Chief Inspector of Stock:—

Recently reports have reached this office from several districts of considerable numbers of deaths among sheep, and as some of these have occurred rather suddenly, the cause has been attributed to anthrax.

From the description of the various organs after *post-mortem* examination, I am convinced that the greater portion of the losses are not occasioned by anthrax, but rather by anæmia, consequent upon dropsical affection induced by liver-rot, or fluke, in an advanced stage.

I am further convinced that much of these losses from the disease last referred to may be averted by change in the system of management.

Sheep have been placed upon country for years past which, in the first instance, in my opinion, was never naturally intended for them; and by continuously stocking, and in some cases overstocking, this country, many of the original and virgin herbages and grasses have been eaten out. The surface features of the land have also changed by reason of storages of water in swamps and breaking out of springs; and in many instances little or no attention has been paid to drainage of land which is naturally devoid of all saline properties, and by that reason most favourable to propagation by natural agencies of fluke, and owners have not, as a preventive, used salt plentifully in addition to sulphate of iron, but have in many instances had recourse to these substances when the disease has become firmly established.

These alteratives are not cures—merely preventives—and tending to assist any natural defect in the country by supplying the requisites to maintain health.

Further, sheep of the same age are, to a large extent, kept in the same paddocks for many months without any change. This, in itself, is a mode calculated to induce disease; and it is only reasonable to suppose that a change of diet is most necessary and essential to good health in sheep, as in all other animals.

Sheep of different ages require different feed, as an animal of a year old, or less, cannot digest, thrive, and maintain good health upon the same diet as an animal of mature age; neither can those that have passed the prime of life assimilate the same class of food as those of a more youthful age.

I am convinced that were sheep changed with tolerable frequency into other paddocks (although it is some labour and trouble to do so) the results would in every way compensate, and the death-rates, as occurring lately, would be, I am sure, considerably reduced; and I would desire, with all respect, to place these suggestions before the owners of sheep in this Colony, in the hope that they may be induced to practically test the mode herein described, and the results will, as before stated, I feel sure, be in every way satisfactory.

Poultry Notes.

By S. GRAY,
Sub-Editor.

By the time this appears the cold weather will be close upon us over a large portion of the Colony, and where it has not already been done prompt steps should be taken to keep fowls warm and comfortable during the winter months. I wish to impress most strongly upon my readers that no matter what kind of fowls they keep, or what their reputation may be as winter layers, warm and dry houses are absolutely necessary. A very great difference of opinion appears to exist on the subject of ventilation. Ventilation is not draught. One of the first steps to be taken is to carefully fill in all cracks in sides and roofs of roosting-houses, so that draughts may be impossible, and then providing some regular means of ventilating the house, which may be done by means of the exit for the birds at the bottom of the door and a few auger-holes along the top. This having been attended to, the floor should be thoroughly cleaned out and sanded, and the interior, including roof, sides, perches, and nest-boxes, thoroughly washed with hot limewash. It will also be found of advantage to provide the birds with a covered run where they can scratch in wet weather. The feeding at this season of the year is also a matter of importance. The morning meal, which should be given as early as possible, should consist of a warm mash having a foundation of pollard mixed with any house-scraps which may be available, and occasionally in the evening good sound maize may be fed with advantage. In very cold weather it is a good plan to litter the covered run with straw, into which a handful or so of wheat or oats may be thrown. The amount of scratching which this will cause will soon put the blood in circulation, and greatly assist in keeping the fowls in health, and consequently in profit. For green food, hang up a head of cabbage, so that the birds can peck at it.

At this time it becomes necessary to decide how many and what birds can be profitably, and with comfort to themselves, retained during the winter. It must not be forgotten that practically all the food required during this season must be supplied, and therefore to retain useless birds would be extravagance. Valuable stock-birds will, of course, be retained for next season's breeding, and, in addition to these, sufficient pullets for laying, and cockerels for the table, should be selected from the flock. The balance, which will under proper conditions consist of young birds, should be sent to market as soon as they are in marketable condition.

It may be as well at this juncture to repeat the advice I have previously given regarding the marketing of poultry. There is no doubt that a little extra care will, as in all other commodities, secure an extra price. If the stock which it is decided to dispose of numbers many head, about two dozen should be penned off to commence with. These should, as far as possible, be of one colour and age. They should be well supplied with food, in order

to bring them to a nice plump condition, and after about a week of careful treatment be placed in a clean coop and dispatched to the nearest or best market. When they are in the coop the reason for selecting them of similar colours will be readily apparent in their improved appearance, and this, combined with equality of age and condition, will not only command an increased price for the particular coop, but will, in all probability, ensure a customer for next market-day. It is in this connection that the recommendation I have often given to keep one, or, at most, two breeds of fowls will be readily appreciated.

With regard to eggs, there are one or two matters which from the existing state of the egg-market would appear to require amendment. There is on many farms a great want of system in collecting eggs. The hens are allowed to get into the habit of laying in all sorts of places rather than in the nest-boxes, and consequently an egg is often collected from some nest which is discovered by accident. The result of this is that there is no certainty when it was laid, and, while the eggs are sent in all good faith to market, the housekeeper finds a rotten egg included in the dozen which she had paid for as fresh. This laying away is often caused by the nest-boxes provided being allowed to become neglected and dirty. A hen will always prefer a secluded and clean nest, and unless she finds this in the fowl-house she will look elsewhere. This is a matter which is well worth attention, and I cannot too strongly impress it upon poultry-keepers. More customers are lost by this than is generally appreciated, and the remedy is simple. Confidence of customers is as necessary to poultry and egg dealers as to Bankers.

Practical Vegetable-Growing.

Directions for the Month of May.

If the directions given during the last few months have been carefully followed, there should now be available an abundance of many kinds of good vegetables for use.

Those readers of the *Gazette* who have some spare ground, but who do not grow their own vegetables, are strongly urged to make a start, if only with a few kinds; for, with a good supply of manure, which should be available on every farm, it is wonderful how great a supply can be obtained from a very small portion of ground. It may be expected that a beginner will make some mistakes, but this should not cause him to lose heart and give up the work, for success can only be attained by patience, perseverance, and practice.

The vegetable most frequently grown in the Colony is the cabbage, and perhaps it is as good a one as any to begin with. It is wholesome and nourishing when well grown, but great size should not be aimed at, those of a moderate size being the best and most palatable. There are many varieties of cabbage, some being best suited for certain districts, and others for different localities; therefore it would be advisable to try several kinds until it be ascertained which particular kind is most suitable. Take, for instance, the Savoy, which comes to the greatest perfection in cool climates, and also the Brussels sprouts, which, when well grown, is one of the nicest of vegetables, but, which, strange to say, is but rarely to be seen in gardens. Of the Savoy and Brussels sprouts there are several kinds, some better than others. Amongst the cabbages—for they belong to the same family—are the borecole or kale of varieties, the broccoli, the cauliflower, and also the turnip-rooted cabbage or Khol Rabi, and there are many kinds of each of these. The general cultivation needed for all these vegetables is much the same. The seed should be sown in small beds, in drills, and when the seedlings come up they must be transplanted to some ground that has been dug up well and heavily dressed with rich farmyard manure. The young seedlings should always be planted out in rows equidistant from one another, and the ground between the rows should be frequently hoed, and kept free from weeds. If it be possible, a thick mulch of farmyard manure should be spread around the plants and between the rows so as to cover all the ground. If this can be done, it will not be necessary to hoe so frequently, unless weeds are prevalent. When moving the young plants from the seed-beds, a good deal of care should be taken to avoid breaking off their roots. A little practice will enable anyone to do this easily and effectively. All garden operations should be done with care and neatness, without hurry. It is far better to produce one good plant than a dozen bad ones. If the plants are moved carefully they will grow right away without flagging or dropping the greater

number of their leaves, which they generally do if pulled out of the seed-beds and planted with a dibber or pointed stick. Cabbage seedlings generally come up very thick in the little rows, unless the seed is sown very thinly, but it is almost useless to advise a beginner, or almost anyone, to sow his seed thin; he will sow thick, and is afterwards afraid to waste his plants by thinning them out. However, the best thing to do will be to "prick out" the plants—indeed, it is an excellent practice to adopt in every case. Pricking out means, to plant out the seedlings on a well-prepared piece of ground a few inches apart, so as to give them sufficient space to grow freely, and when they are good strong plants they can be shifted to the places where they are to finally develop. This pricking out may be adopted for other plants besides the cabbage family. Lettuces, celery, leeks, tomatoes, may all be improved by this little extra trouble. Everyone who grows vegetables should bear in mind that it is a great mistake and waste to sow much seed at a time. It may be stated that cauliflower seed does not, as a rule, come up nearly so well as cabbage. Why this should be the case it is difficult to say.

When growing other kinds of vegetables than the cabbage it will also be advisable to try several varieties of each. Amongst onions there is considerable diversity. Some are very large, others small; some are most highly flavoured, others mild. Then allied to the onions to some extent are the leeks, shallots, chives, and garlic, all useful for various purposes.

The carrots vary considerably; some long, others medium-sized, and again some are almost like turnips in shape. And so on with all vegetables. Great efforts are made by those in the seed-growing business to produce new and improved varieties, but not infrequently the size is improved but quality sacrificed.

Asparagus.—If some ground has not already been prepared for planting it should be taken in hand soon, so as to be quite ready for planting during the winter or early spring before the shoots or buds start into growth.

Artichoke (Globe).—Plants or suckers may be planted at any time during the month. The soil should be a rich sandy loam, moist but well drained, for this vegetable to come to perfection. Half-a-dozen plants will probably be enough to grow. They may be planted in a row about 3 to 4 feet apart. The artichokes will succeed pretty well on most soils, if not too dry, provided the ground be well manured.

Beans, Broad.—Seed may be sown largely during the month, say a short row or two, at intervals of a week.

Beans, Kidney or French.—Should only be sown in the warmest parts of the Colony, where frosts are not likely to occur. Old plants should be cleared out of the garden immediately they cease to be productive. One great secret of success in producing a large quantity and variety of vegetables on a small space of ground is to prevent old useless vegetables from occupying valuable land which should be manured, dug up, and put under crop as soon as possible. This does not seem to be generally understood.

Brussels Sprouts.—Sow a little seed during this month in a seed-bed, or even in a box, in order to have some plants coming on for successional planting. If strong plants can be obtained they may be planted out.

Cabbage.—Sow seed of several varieties, as recommended before, once or twice during the month. If strong seedlings are available plant them out.

Cauliflower.—Sow a little seed occasionally, and plant out strong seedlings, a few at a time.

Carrot.—This is a most useful and wholesome vegetable to have on hand. ow a little seed occasionally in drills about a foot to 18 inches apart. prinkle the seed thinly along the shallow drills, and cover by hand with fine il. The seeds are covered with little hooks, and this causes them to stick gether. Before sowing rub the seeds so as to separate them. Keep ung plants free from weeds. The soil for carrots had better not be freshly anured or else they are liable to fork. If the ground is very poor, and it necessary to apply manure, use that which is thoroughly rotted, and mix well with the soil.

Celery.—Sow a very little seed, and plant some good strong seedlings in allow trenches. Apply a heavy dressing of manure before planting.

Endive.—This is a plant rather like lettuce in appearance, and it is used a salad. Sow a little seed, in the same manner as you would lettuce, and terwards transplant the seedlings when they are large and strong enough. he soil should be made rich, for the plants should be grown quickly so as to ve them tender.

Leek.—Sow some seed, and plant out the seedlings when they are 8 inches so in height. The ground must be made very rich to grow the leek to rfection, for it is a greedy feeder.

Lettuce.—This a good time to sow seed, and also to plant out strong edlings from previous sowings. Move the plants without breaking any ots if possible. The great object to attain is to grow the plants without a eck, and this can be done if they are carefully taken out of the ground, d carefully planted. Make the soil rich with well rotted manure.

Onion.—A most useful and wholesome vegetable which should be grown rgely. The ground should be made rich and worked fine on the surface, d particular care should be taken to have the beds well drained. Sow in ws, and barely cover the seed with fine soil. Keep the beds quite free om weeds, and to facilitate weeding, the beds should be made narrow. ot mixed with salt half and half, makes a useful top-dressing sprinkled nongst onions when they come up.

Parsley.—Sow some seed of this useful plant.

Parsnip.—Sow a little seed in drills. This is a deep rooting plant, and erefore the soil should be deeply worked.

Peas.—Keep on sowing a row or two from time to time in order to keep a continual supply if possible for it is hard to find a better vegetable than e pea. Sow in rows about 3 feet to 4 feet apart. The drills shall be about nches deep, and the peas about 3 inches apart in the drills.

Radish.—Sow a little seed frequently in order to keep up a supply.

Sea Kale.—Sow a very little seed.

Spinach.—Sow a little seed.

Shallots.—Plant out some bulbs or cloves in rows about 12 to 15 inches art. Do not bury the clove deep but just press it firmly into the soil.

Herbs.—Sow seed and lift, divide and replant old plants.

Orchard Notes for May

MAY, coming between the season of the summer or deciduous fruits and that of the main crop of the most of the citrous fruits, is usually a somewhat slack time for orchardists as far as the gathering and marketing of their produce is concerned. Still, it should be by no means an idle time, as in an orchard there is always work to do if it is to be kept in the proper condition necessary to produce the best results. Any extra work that is required can be done now, such as draining, where necessary, and the scouring out of all existing surface or open drains, as well as seeing that the outlets of all such drains are clear, so that there is a get-away for the water, and that the drains themselves are in good working order, as a choked drain is often worse than no drain at all. All dead or valueless trees that it is desirable to remove should be taken out now if not done previously; and the hole from which they are taken should be allowed to remain exposed to the air till the new tree is planted that is to replace the one taken out. Any fences or gates that require mending should be mended, and any other odd jobs there may be should be attended to when you have the chance, as in a busy time they are apt to be overlooked, and though often insignificant in themselves, the neglect to attend to them often causes considerable inconvenience or loss. In fruit-growing there is only one secret of success, and that is thoroughness. The better the orchard is kept, the better fruit it will produce and the better it will pay; and bear in mind that if an orchard will not pay when properly managed, then it will not pay in an untidy or neglected state.

If it is desirable to lime the orchard, and if the soil is of a sticky, retentive nature, liming, as an adjunct to draining, will be found to be of very great value—not so much from the manurial value of the lime itself, as from the mechanical effect it produces, by bursting up the soil, and rendering it more friable, and therefore more easily worked. Lime has also a good chemical effect on the soil, besides its mechanical one; as, if the soil is at all sour, it sweetens it by directly neutralising the free acids present in the soil, and to which its sourness is due; also, by its action in bursting up the clayey matter of the soil, it also renders a considerable portion of the potash contained in the clay available for plant food, and potash may be said to be the dominant ingredient in the ash of nearly all of our fruits, as it is more largely required by the fruits than any other plant-food which it is necessary to supply to the soil in the form of manure when it is not present in the soil in sufficient quantity. If lime is required for its mechanical and chemical effects, rather than for its purely manurial value, it should always be applied in the caustic form—that is, unslacked, or only sufficiently slacked to permit of its being evenly distributed, when it should be lightly ploughed in at a rate of 2, 3, or even 4 tons per acre, according to the nature of the soil. Never apply any other manure at the same time as the lime, or the lime will set free all the ammonia it contains, so that it will pass off in the form of gas, and be lost.

Insoluble or only slowly soluble manures, such as bone-dust and boiling-own refuse, can be applied during the month to either citrus or deciduous uit-trees where the soil is not of a too sandy or porous nature, as they will ecome slowly available for plant-food during the winter months, and will e ready for the tree's use when they start their spring growth.

Pruning can be commenced during the month with plums and peaches if l the leaves have fallen, as the sooner it is done after the leaves are off the ee now the better, as the energies of the tree are then devoted to maturing e buds that are left instead of all that are on the tree, a large number of hich will in any case have to be pruned away afterwards. Where new chards are to be planted out the land should be got ready when not done eviously, but with new land it is always preferable to have the land broken p some months previous to planting so that it may become thoroughly eetened.

The main crop of lemons will be getting ready for gathering during the onth, and as soon as they ready for gathering, that is, just as they are eginning to turn colour, they should be cut from the trees and cured stead of being allowed to remain on the trees to the detriment of the uality of the fruit and to the injury of the tree. The process of curing the mons, of which a full description appeared in the *Agricultural Gazette*, ol. iii, p. 666–669, is a simple one, and success depends very largely on the re taken in the gathering and handling of the fruit.

General Notes.

ADMISSION OF STUDENTS TO HAWKESBURY AGRICULTURA COLLEGE.

IN connection with the selection of candidates for admission to the Hawkes bury Agricultural College, the Minister for Mines and Agriculture has ha under consideration a proposal which it is thought will prove more satisfactor to candidates, and of less inconvenience to the Department than the syster hitherto adopted, under which every applicant for admission, irrespectiv of educational attainments, was compelled to undergo entrance examinatior The Minister has now decided that candidates who can produce a certificat of having passed the Civil Service or higher examination will be chosen t fill vacancies in the order of priority of application with, of course, as befor due regard to moral character and general fitness for the College cours For those candidates who have not passed any educational examinatio arrangements will be made to hold an entrance examination, and the lad obtaining the requisite percentage of marks in such test will be admitted i the order of application.

INSTRUCTION IN SERICULTURE.

IN connection with the appointment of an expert in silk culture, the cond tions upon which instruction will be imparted to pupils, with a view t extending the industry to suitable portions of the Colony, have now bee decided. At the present time the Department is in possession of the whit mulberry orchard belonging to the A.A. Company at Booral, near Stroud, wher the expert is engaged in rearing and feeding the worms resulting from th eggs presented to the Department from Italy, as well as in improving the con dition of the trees with a view to providing sufficient food of the necessar succulent character. The conditions are that a limited number of student be received at the Booral plantation for general instruction in sericulture, a the rate of £5 per annum, payable quarterly in advance; that such student provide their own board and lodging; that they be allowed to remain at th plantation for a period of twelve months, but, if they so desire, they ma leave at the end of any quarter. If any student desires to remain longe than twelve months special permission must be obtained from the Ministe In the admission of students, preference will be given to those who satisf the Department that they have facilities for carrying on the business of sil culture after the course of instruction is complete. All students will b required to comply with the rules and requirements of the instructor (M Brady), and failing therein, upon the recommendation of Mr. Brady, the may be dismissed from the plantation. The first year to commence on th 1st September next. The above date has been fixed consequent on the lac

f accommodation, and the absence of facilities for carrying on the work, oth of which wants are in course of provision, but in the meantime three dies who have expressed themselves as willing to take matters as they are, ave been permitted to enter upon a course free of charge for the balance f the present season, and are now hard at work at Booral, gaining practical xperience of the work which is proceeding there.

The Silk Industry in Switzerland.

he United States Consul at Horgen, in a recent report, presents in a brief rm the general result of the Swiss silk season of 1892–93, as obtained om a Statistical Review, published by the Association of Silk Manufacturers the canton of Zurich.

A season or campaign, it is stated, comprises all the stages silk passes rough, from the breeding of the worm to the marketing of the finished brics, including fluctuations in price, &c.

From the review mentioned, it is gathered that the world's total production raw silk in 1892-93 was the largest on record, exceeding the production the preceding year by 370,000 kilogrammes (815,480 English pounds), nounting to 12,529,000 kilogs. (27,613,916 pounds), while in the five years om 1881 to 1885 the crop averaged 9,631,874 kilos. (21,228,650 pounds), d in 1886 to 1890, 11,375,000 kilos. (25,070,500 pounds). The production raw silk is steadily on the increase, caused by various agencies, among ich are mentioned as of special interest:—

(1.) The large increase of silk culture in Syria and other parts of the Ottoman Empire, as a consequence of its encouragement and promotion by the administration of the Ottoman debt.

(2.) The great flexibility and practicability of extension of the eastern Asiatic exportation, the amount of which, as is well known, not only depends on the result of the crops, but also on the reigning market prices. In the interior of China and Japan there are always to be found large stocks—we might call them reservoirs—of silk, partly for home consumption and partly representing gold and silver. When prices of silk are high, parts of these reserves are thrown on the market for exportation, while as soon as prices drop these stores are closed again. This will explain why the amount of exportation was larger toward the end of the season than had been presumed at its beginning.

The silk crop of 1893 is estimated at 14,070,000 kilos. (31,018,722 pounds). this total production Europe shares with 4,977,000 kilos. (10,972,294 unds), the Levant with 923,000 kilos. (2,034,845 pounds), and eastern ia with 8,170,000 kilos. (18,011,582 pounds).

An excess of consumption—which means a diminution of stock—in 1892- of 2,004,000 kilos. (4,418,018 pounds) will be only partly balanced by an rease of production in 1893 of 1,541,000 kilos. (3,397,288 pounds). If the season of 1893-94 the consumption should proceed in the same prortion, the general stock would be further reduced about 463,000 kilos. ,020,729 pounds), and even if consumption should fall to the average level 1890-91 and 1891-92—11,800,000 kilos. (26,014,280 pounds)—the supply the market would only approximately reach the figure with which the ely season of 1892-93 had opened.

As far as Switzerland is concerned, the importation, as well as exportation, silk in 1892-93 (according to weight) manifested an ascending tendency

after a slight decline in the previous year, the importation of 5,042,000 kilos. (11,115,593 pounds), showing an increase of 14 per cent., and the exportation of 5,941,000 kilos. (13,097,528 pounds) an increase of 7 per cent. This is due, in the first place, to the larger transactions in the spun-silk industry, the materials of which show an increase of 25 per cent. in importation and of 20 per cent. in exportation; and, in the second place, to the increased import and export of raw silk. The export of silk thread, too, is on the increase. As to fabrics, a decrease of import is to be recorded, which is almost exclusively confined to piece goods and ribbons of pure silk, and may be ascribed to the interrupted commercial relations with France, *i.e.*, to a smaller purchase of merchandise from there. The import of half-silk fabrics, however, has considerably increased. The export of fabrics has remained stationary as to weight, a slight decrease in piece goods being counterbalanced by an increase in ribbons. The export of silk embroideries has dwindled down—in consequence of their neglect by fashion—to less than half of its former amount.—*Board of Trade Journal*, January, 1894.

Phylloxera Resisting Vines.

In view of the recent outbreak of phylloxera vastatrix in Victoria, the Minister for Mines and Agriculture, N.S.W., is taking timely steps to introduce from France seeds of the better known phylloxera-resisting stocks.

Seeds of the following varieties have been ordered:—Vitis Riparia, Vitis Rupestris, Solonis, York's Madeira, and Vitis Berlandeiri.

It may be mentioned that small quantities of these stocks are already being propagated at the Gosford Nursery, and in the course of time it is hoped the Department will have a sufficient supply to give our leading vinegrowers an opportunity to graft extensively on to these well tried phylloxera-resisting stocks.

American Wheats.

The Department has also received from Chicago half-bushel bags of some twelve varieties of the best wheat under cultivation at the experimental stations in the United States.

These will be planted at the experimental farm, Wagga Wagga, and when acclimatised, the resulting seed should prove a valuable addition to the strains of wheat at present being grown in New South Wales.

Trade with Canada.

With a view to furthering the opening up of commercial relations with Canada, in which direction some steps were taken by the Department at the departure of the Hon. Mackenzie Bowell, a number of samples of Australian wool, accompanied by catalogues, were in September last handed to Messrs. Burns, Philp, & Co., agents for the Canadian-Australian S.S. Line, for transmission to that country. In connection with this shipment the Department was recently advised by the agents that these samples safely arrived at their destination, and had been distributed, one box to the woollen mills at Sherbrooke, one to Dundas, one to Almonte, and the other one to the woollen

mills at Cornwall, near Montreal, these comprising the most important woollen industries in Canada. Messrs. Burns, Philp, & Co. express the hope, in which our readers will doubtless join, that the distribution of these samples will be attended with success, and be instrumental in promoting the development of the woollen trade between this Colony and Canada.

Insects Injurious to Stored Grain.

If any proof were required of the superiority and thorough effectiveness of bi-sulphide of carbon for the destruction of any of the known insects which attack stored grain, such is amply supplied in a Bulletin under the above title issued by the Delaware (U.S.) College Agricultural Experimental Station. This pamphlet gives the results of a number of practical experiments with stored grain of various kinds attacked by their respective pests. Thus wheat attacked by the grain beetle (*Silvanus surinamensis*, Linn.) and by the granary weevil—that generally found in flour—(*Calandra granaria*, Linn.); rice, by the rice weevil (*Calandra oryzae*, Linn.); peas, by the pea weevil (*Bruchus pisi*, Linn.); beans, by the bean weevil (*Bruchus obtectus*, Say.), and by the four-spotted bean weevil (*Bruchus 4-maculata*, Riley); wheat, corn, oats, barley, sorghum seed, and recently cow peas, by the angoumois grain moth (*Galechia cereallela*, Oliv.), have each and all of them been successfully cleared and the uninjured portions of the grain saved for market. In the course of the various experiments it has been proved that 1 oz. of the liquid to each 100 lb. of grain is sufficient, unless the grain is exceptionally badly affected, and that satisfactory results are obtained even where the receptacles in which the grain was placed were not air-tight. In such cases it has been found sufficient to cover the grain, after the liquid has been evenly sprinkled over the top, with a blanket or other similar material for about three hours, although a longer period is preferable. The grain is then screened and the dead insects thereby removed, leaving the grain perfectly clean. It may be mentioned that grain treated with this chemical is not in any way injured either for market or for seed, while the cost of the treatment is about 1 per cent. per bushel. There is, of course, a certain amount of danger incurred in the use of the bi-sulphide, but it may be used without fear, if the operator is ordinarily careful, provided *lights or fire are not brought near the liquid or the fumes from it.* An officer of this Department has used it regularly for the past four years without accident.

Profitable Dairy Stock.

From a paragraph in a recent issue of the *Shoalhaven Telegraph*, it appears that Mr. David Hyam scored as follows at the Kiama show:—Alderney or Jersey cattle for dairy purposes. Judges: A. Warden and T. N. Grierson. Alderney or Jersey bull, 3 years and upwards, D. Hyam; ditto ditto, 2 years and under 3, D. Hyam 1, G. Gray 2; ditto ditto, 1 year and under 2, D. Hyam 1 and 2; ditto ditto bull-calf, under 12 months, D. Hyam; ditto ditto cow, 3 years and upwards, D. Hyam 1 and 2; ditto ditto heifer, 2 years and under 3, that has not had a calf, E. M'Clelland 1, D. Hyam 2; ditto ditto heifer, 1 year and under 2, that has not had a calf, D. Hyam 1 and 2.

The following is the result of the butter tests at the above show:—

Mr. Hyam's Jerseys.

	lbs. Milk.	Butter Test.
Shamrock	27½	5·4
Zoe	27	5·8
Dollie	20½	7·2
		17·14

Average, 5·71.

Other Owners.

Queenie	31	3 9
Queen	22½	2·3
Rose	29½	3·0
Alice	20½	3·6
Twin	26	1·6
Lizzie...	31	3·2
Violet	33	3·5
Diamond	34½	2·6
Frosty	31	3·2
Beauty	30½	3·6
Easy	22	2·8
		28·53

Average, 2·59.

AGRICULTURAL SOCIETIES SHOWS, 1894.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindale	Jan. 9, 10.
Clunes Agricultural Society	J. W. Brown ...	,, 17, 18.
Albion Park A. and H. Association	T. Armstrong ...	,, 17, 18.
Kiama A. and H. Association	J. Somerville ...	,, 25, 26.
Holt-Sutherland H. and I. Society	W. Douglas ...	,, 26.
Wollongong A. and H. Association	A. J. A. Beatson...	,, 31, and Feb. 1.
Berry A. and H. Society	A. J. Colley ...	Feb. 6, 7, 8.
Gosford A. H. and I. Association...	H. S. Bevrendge...	,, 9, 10.
Luddenham A. and H. Association	K. Campbell ...	,, 13, 14.
Manning River (Taree) A. and H. Association ...	W. Plummer ...	,, 14, 15.
Lithgow A. and H. Society	M. Asher... ...	,, 15, 16.
Shoalhaven (Nowra) A. and H. Association ...	R. Leeming ...	,, 15, 16.
Marulan P. and H. Society	H. Morrice ...	,, 23.
Kangaroo Valley A. and H. Society	H. Joyce	,, 25, 26.
Candelo A. and H. Association	C. H. Brooks ...	,, 27, 28.
Tumut A. and P. Association	W. H. Bridle ...	,, 27, 28.
Tenterfield P., A., M., and H. Society	J. Harker... ...	,, 27, 28, and Mar. 1.
Port Macquarie A. and H. Society	A. E. Poutney ...	,, 28 and Mar. 1.
Lismore A. and H. Society...	C. S. Connor ...	,, 28 and Mar. 1, 2.
Berrima District (Moss Vale) A., H., and I. Society	J. Yeo	Mar. 1, 2, 3.
Nepean District (Penrith) A., H., and I. Society	R. Benaud ...	,, 1, 2, 3.
Robertson Agricultural Society	R. J. Ferguson ...	,, 6, 7.
Uralla P. and A. Association	J. D. Leece ...	,, 6, 7.
Bega A. and P. Association	A. J. Wilson ...	,, 7, 8.
Inverell P. and A. Association	J. M'Ilveen ...	,, 8, 9.
Picton Agricultural Society	G. Bradbury ...	,, 8, 9.
Cobargo A. and P. Society...	J. Graham ...	,, 13, 14.
Tumberumba P. and A. Society	W. Willans ...	,, 13, 14.
Glen Innes P., A., and M. Association	J. Denshire ...	,, 14, 15.
Goulburn Agricultural Society	J. J. Roberts ...	,, 15, 16.
Gulgong Agricultural Association...	S. Turner... ...	,, 16, 17.
Armidale (Combined Show), A. and P. Association	W. H. Allingham	,, 20, 21, 22.
Taralga A. and P. Association	J. J. Walsh ...	,, 21, 22.
Royal Agricultural Society (Sydney)	F. Webster ...	,, 21 to 27.
Braidwood P. and A. Association...	G. F. Taylor ...	,, 22, 23.
Castle Hill A. and H. Association...	F. H. G. Rogers...	,, 26, 27.
Orange A. and P. Association	J. S. Thomas ...	,, 28, 29.
Walcha P. and A. Association	H. Chapman ...	April 4, 5.
Lower Clarence (Maclean) Agricultural Society...	J. S. Dunnet ...	,, 4, 5.
Camden A., H., and I. Society	W. R. Cowper ...	,, 4, 5.
Gundagai P. and A. Society	W. E. Kyle ...	,, 5, 6.
Blayney P. and A. Association	G. H. Woolly ...	,, 5, 6.
Gundaroo P., A., and H. Association	J. Affleck... ...	,, 6.
Namoi (Narrabri) P., A., and H. Association ...	J. Riddle... ...	,, 11, 12.
Bathurst A., H., and P. Association	W. G. Thompson..	,, 11, 12, 13.
Clarence (Grafton) P. and A. Society	T. Page	,, 18, 19.

Society.	Secretary.	Date.
Wellington P. and A. Association	R. Porter	April 18, 19.
Hunter River (West Maitland) A. and H. Association	W. C. Quinton ...	„ 18, 19, 20.
Dubbo P., A., and H. Association...	G. H. Taylor ...	„ 24, 25, 26.
Warialda P. and A. Association	W. B. Giddes ...	„ 25, 26.
Mudgee Agricultural Society	J. M. Cox ...	„ 26, 27.
Macleay (Kempsey) A. and H. Association ...	H. R. Gray ...	May 9, 10, 11.
Gwydir (Moree) P. and A. Association	J. G. Cohen ...	„ 9, 10.
Upper Hunter (Muswellbrook) A. and H. Association	Price Healey ...	„ 16, 17.
Upper Manning (Wingham) A. and H. Society...	J. J. Herkes ...	„ 16, 17, 18.
Hornsby, Thornleigh, Pennant Hills, &c., H. Association	H. Epthorp ...	„ 23, 24.
Cumnock P. and A. Association	W. Newmarch ...	„ 24.
Warren P. Association	F. C. Thompson ...	June 7, 8.
Cobar P. and A. Association	A. Roxburgh ...	„ 13, 14.
Riverina (Jerilderie) P. and A. Society	J. Fulton... ...	July 24, 25.
Forbes P., A., and H. Association...	W. G. Dowling ...	Aug. 9, 10.
Northern (Singleton) Agricultural Association ...	C. Poppenhagen ...	„ 15, 16.
Cowra P., A., and H. Association...	S. Wright... ...	Sept. 5, 6.
Burrowa P., A., and H. Association	J. F. Clifford ...	„ 13, 14.

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[3 plates.]

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CONTENTS.

Useful Australian Plants.

BY J. H. MAIDEN,
Consulting Botanist.

No. 10.—THE TALLOW-WOOD.

(*Eucalyptus microcorys*, F. v. M.)

Other Vernacular Names.—Usually in New South Wales it bears the one name of tallow-wood, which has been given to it owing to its greasy nature, which is most marked when freshly cut. In Queensland it is known as "turpentine tree," and also as "peppermint," the foliage being remarkably rich in volatile oil. In the same colony it also goes under the name of "red stringybark," owing to its reddish fibrous bark, and not because of the colour of its wood, as are red stringybarks in New South Wales.

Aboriginal Names.—By the aborigines of the Richmond River, New South Wales, it used to be called "Wangee." Those of the Brisbane River, Queensland, used to call it "Tee."

Botanical Name.—The name *Eucalyptus* has been already explained. *Microcorys* is made up of two Greek words, signifying "a little helmet," and is in allusion to the comparative smallness of the cap (*operculum*) of the flower.

Flowers.—Mr. Forester Martin observes that tallow-wood flowers in August and September (October should be added—J.H.M.) in his district, and that the flowers are much sought after by bees. I may mention that, on behalf of the beekeepers of the Colony, the Department is busily collecting information in regard to the best flowers for bees and the periods during which they are out. As is well known, many eucalypts have irregular flowering periods, and the Department is trying to ascertain the period in each district for particular years.

Fruit.—The fruits are comparatively long and narrow. Their shape is brought out in the drawing, and, if this be mastered, a fruit-bearing tallow-wood twig cannot be mistaken for anything else.

Leaves.—The fresh leaves of the tallow-wood yield 1·960 per cent. of an essential oil of an acid reaction, and a specific gravity of ·896 (Staiger). Other figures give 375 oz. to the ton of leaves, which equals 1·046 per cent.

Schimmel & Co., of Leipzig, in their October, 1893, *Bericht*, give the specific gravity of this oil at 15° C., at as high as ·935, and give its boiling point at 160° and 200°. They further state that it contains Cineol (*Eucalyptol*).

The oil is stated to have a not very agreeable odour, but it probably might be found useful in varnish-making. I hardly know, at present, how to reconcile the above statement with the following:—

"The oil of *E. Baileyana* and those of *E. microcorys* and *E. citriodora* are very similar to one another. They possess a magnificent melissa-like

odour. It is thought they will prove to possess extraordinary practical value. Chemically, the three oils are quite characteristic. Neither of them contains a terpene, but they consist of a ketone ($C_{10} H_6 O$), smelling like melissa, and a body that is probably an alcohol ($C_{10} H_{18} O$?), which possesses a beautiful odour resembling that of geranium."—*Messrs. Schimmel & Co., of Leipzig, in Pharm. Journ.* [3], XVIII, 907.

As regards the oil of *E. citriodora*, I may mention that its composition has since been determined. I would very much like to have an opportunity of examining a guaranteed oil of *E. microcorys*. If any reader of the *Gazette* will forward me such a sample, I will promise to furnish an exhaustive report on it. Distillers of eucalyptus oil are on the look out for new trees in order to see if the products they yield are of improved value. Why not try the tallow-wood (*E. microcorys*)? It is certainly worth testing, and there may be money in it.

Exudation.—The "gum" or kino from the tallow-wood is one of the most interesting of such substances. I do not think it is of such medicinal value as those from most other eucalypts, but it is of scientific interest, and the following account of some specimens examined by me a few years ago form the first investigation into the substance:—

a. Sample of Kino from New England, N.S.W., received 1886.

Kino of this species is less vesicular than that of *E. maculata*, but almost as readily reducible to a powder. This particular specimen is in small pieces, for the most part of the size of currants. In bulk it looks remarkably like a parcel of uncut garnets. Owing to its friability, the bright fractures become dulled with very little friction. Colour of powder, orange-brown.

To cold water a yellow solution is yielded, with a slight tinge of brown, having a turbid residue of a dirty yellow colour, with a few black or dirty particles. Eventually almost everything dissolves, with the exception of a little accidental impurity.

It was analysed October, 1888, with the following result:—

Catechin and tannic acid	81·2
Resin	trace.
Ligneous matter, &c....	·4
Moisture	18·1
Ash	·3
	100·0

Tannic acid determination (Lowenthal), 54.349 per cent.

b. A sample from Uralba, Wardell, N.S.W., collected May, 1891, has also been examined. It is a new sample, with no important differences from the foregoing.

It was analysed August, 1891, with the following result:—

Catechin and tannic acid	76·39
Resin	·08
Ligneous matter, &c.	·87
Moisture	20·4
Ash	1·54
	100·00

Tannic acid determination (Lowenthal), 50·45 per cent.

The presence of resin in a weighable quantity in this kino is worthy of notice.

c. Two samples from Queensland, received from Mr. F. M. Bailey, F.L.S., Colonia Botanist.

The physical description of the preceding sample will apply here. In cold water the layer at the bottom of the vessel becomes, if undisturbed, of the colour of treacle. The tint is precisely the same as that of a guaranteed sample of *Pterocarpus marsupium* kino received from India. It leaves a small quantity of a brown residue, which produces turbidity if disturbed.

Water at 100° C. (1 grm. to 1 litre) yields a beautifully clear solution, of the colour of colza oil. This remark applies also to the preceding sample.

It was analysed October, 1888, with the following result:—

Catechin and tannic acid	82·1
Resin	trace.
Ligneous matter matter, &c.	·5
Moisture	17·2
Ash	·2
	100·0

Tannic acid determination (Lowenthal), 56·883 per cent.

Mr. Staiger says of a Queensland sample of this kino:—"The specific gravity is about 1·395, and the percentage of tannin 53·33. The solution in water when evaporated yields brownish scales."

Bark.—The bark (often of a "corrugated" appearance), is sub-fibrous, of loose and even woolly texture. In colour it is of a sort of brick or rusty red, and is persistent even to the smallest branches.

The Timber.—Tallow-wood is one of the most valuable timbers the Colony produces. It is strong and durable under or above ground. Its colour is yellowish-brown or yellowish, and, like many other timbers, darkens with age. Its greasiness has been referred to elsewhere.

It is used by wheelwrights for naves, felloes, and spokes (W. Hill), cogs, also for flooring, *e.g.*, in ballrooms; for this latter purpose it is selected on account of its greasy nature. It is also used for the floors* of a number of large Sydney buildings. It is used for the decking of bridgos, bridge work in general, and culverts.

It is used for pickets, also for turnery, *e.g.*, the turned pillars of verandah posts, for mouldings and architraves, and for all building purposes requiring strength and durability, *e.g.*, slabs, piles, and posts, and for sawn stuff generally. Mr. Forester Deverell, of Glen Innes, knows slabs in a hut sound now after eighteen years in use. It would not be possible to enumerate all the uses to which this valuable timber is put in New South Wales and Queensland.

The following interesting notes by Mr. Forester Brown, of Port Macquarie, I give, even at the risk of a little repetition:—"Tallow-wood is suitable for any dry work. It is easy to work on account of its greasy nature, and is the best timber for any purpose where a smooth surface is required, particularly for a ballroom floor. All that is required to revive the greasy nature for dancing is to spread a few loads of the sawdust on it for a day or

* Mr. Forester Martin says it is not used for flooring-boards in his district.

two; we then have a perfect floor. It does not burn very readily; white ants do not attack it as readily as blackbutt, &c. It is a good timber for bridge decking; it is not good for rafters and studding for buildings, as because of its greasy nature the nails will draw. It is the only timber we have of a greasy nature, and it has the effect, when being worked, of cleaning and keeping clean tools such as saws, &c., which have got gummed in working other timber. It is fairly durable in fresh water. Many years ago, when ink was short, the farmers on the rivers used to brand their bags of produce by means of an ink made by steeping chips of tallow-wood in water for a day or two (presumably in contact with iron). Tallow-wood is generally preferred to blackbutt for the same uses."

The notes of Mr. Forester Pope, of Murwillumbah, Tweed River, may be given here: "The timber, if left alone by white ants, will last almost any number of years above or below ground. It is hard, strong, and fairly easily worked. The Roads Department use a quantity of it here for decking in culverts, bridges, &c., and it seems to stand traffic well. It is difficult to split because of the presence of a greasy or waxy substance, making it a tedious matter to get a wedge to "draw," but when split it makes splendid posts and rails. It does not burn well, as when burning it exudes a kind of juice which puts the fire out."

Mr. Forester Pope says that in his district the bark is always riddled within a quarter of an inch of the sapwood with white ants. "This is a great drawback to the value of the timber; it appears to suit them exactly. There is generally a huge nest of them in the head. It seems to be the first timber they attack."

The timber shows black stains where nails are driven, unless it is well seasoned.

Mr. Forester Rudder says that he knows of no timber that suffers so little from exposure after being cut down. Even if left for many years the mature wood remains as fresh as in the growing trees.

It is sometimes urged against tallow-wood that it does not hold nails well. It also shrinks, but the effect of this can be guarded against by seasoning, which is rather a longer process than with most timbers. It is, however, worth a little trouble, as it fetches a higher price than most other hardwoods.

According to Mr. Forester Rotton, tallow-wood charcoal is considered one of the best for the smithy.

A drawback to this valuable timber is the liability it shares with blackbutt to what are called "pin-holes." These are caused by the boring of the larvæ of a small beetle probably belonging to the genus *Anobium*, and possibly to an introduced species. The insect damages a large number of colonial timbers, being chiefly found in the sapwood of very many. It is rather difficult to destroy.

Tallow-wood for Paving.—I believe tallow-wood to be an excellent wood for paving, but we really know but very little about the relative merits of colonial hardwoods for paving. We have miserably few data, and these are not satisfactory, for it is manifestly absurd to compare (say) blackbutt and red gum, without having some idea that the timbers were procured under something like comparable conditions. In heaps of blocks for paving I have observed every possible quality of the same timber; in order to obtain some

valuable data in regard to the merits of a timber, it is manifest that the observations must be conducted with every possible scientific safeguard.

Mr. R. W. Richards, the Sydney City Surveyor, has, in a recent report, given the following information in regard to certain tallow-wood blocks, but unless duplicates were preserved at the time of laying, I am afraid that we are not in a position to fully comprehend what these results mean:—

Block No. 1 was taken from Pitt-street; width of carriage-way, 36 ft.; position of block, 18 ft. from kerb; original depth, 6 inches; average depth on removal, 5⅜ in.; laid in July, 1881; removed December, 1892; width of joint, ¾ in.; rate of wear per annum, $\frac{1}{15}$ of an inch.

Block No. 2 was taken from George-street; width of carriage-way, 64 ft.; position of block, 30 ft. from W. kerb; original depth, 6 in.; average depth on removal, 5⅔ in.; laid in October, 1883; removed December, 1892; width of joint, ½ in.; rate of wear per annum, $\frac{1}{18}$ of an inch. I must refer my readers to the original report; but the results obtained place this timber in a favourable light, and it is one of six timbers recommended by the City Surveyor for paving.

Mr. Richards' opinion of the value of tallow-wood is more definitely stated in the sentence:—"At the time of writing, all the old blocks have been removed, and the paving relaid with blocks of blackbutt and tallow-wood."

Tests of Strength of Tallow-wood.—Following are the particulars of some experiments on tallow-wood, conducted at the Railway workshops at Newport, Victoria, in 1884. The samples tested were each 7 ft. in length by 1⅞ in. square; the distance between the bearings was 6 ft., and the weight was gradually applied in the centre till the sample broke. The timber was of New South Wales growth, and seasoned at least 12 months.

The weight of each sample was 9¾, 10½, 10¼ lb.

Average weight per cubic foot, 59·43 lb., and therefore its specific gravity was 0·952.

The breaking weight of each sample was 6 cwt. 2 qr. 20 lb., 6 cwt. 2 qr. 24 lb., 7 cwt. 1 qr. 17 lb. Therefore, the average breaking weight of the samples was 776·3 lb. The deflections at the points of rupture were 5¼, 4, and 4½ inches respectively. The average specific strength was given at 2,119.

Education in Colonial Timbers.—Tallow-wood is a timber that has suffered much at the hands of ignorant or designing persons, who have substituted inferior timbers, bearing a resemblance more or less close to it.

White mahogany (*Eucalyptus acmenoides*) is often passed off for tallow-wood. The former is a valuable and durable timber, but still much inferior to tallow-wood. Young tallow-wood is far from being as good as old timber. Mr. Forester Deverell complains that tallow-wood is not extensively used in his district, and justly considers that this "is from ignorance, and also from timbers of much inferior quality being more easily got." At the same time, tallow-wood is one of the easiest of colonial hardwoods to recognise, and there should be no real difficulty in the matter. Of course an incompetent person can be "let in" whether the article is colonial hardwood or any other material of construction, and I cannot help thinking that the cry of

the similarity between colonial timbers is a little overdone. The cry is often employed by incompetent persons to distract attention from their ignorance in diagnosing colonial timbers. I think the time has now arrived for officers in Government or municipal employment who have, in the ordinary course of business, to diagnose hardwood, to pass an examination in the subject, just as professional men have to do in regard to other materials of construction. The pity is that we have so many men here learned in European and American timbers, and only possessing a rule-of-thumb knowledge of the timbers of the country in which they were born, or in which their lot is cast. How the knowledge shall be imparted or tested is a mere matter of detail; that the reform is desirable is undisputed, and I hope I may live to see it carried out. Knowledge of colonial timber can only be obtained by handling it as sawn stuff, and by careful observations as to the circumstances under which it grows in the forest. The subject is not an easy one, and I don't intend to say it is. There is no more a golden road to a knowledge of colonial timbers than there is to a knowledge of Greek. Very often the man who knows least about our colonial timbers is readiest to assail them. We must suspend our judgment with regard to the absolute merits of many of them, and what I plead for is a systematic attempt to get at the value of each timber—to test it from various points of view. Many of our timbers have not had a fair "show." These are times of reduced expenditure, but I would like to see £10,000 spent on a proper survey, examination, and test (not merely of strength), of colonial timbers. The sum mentioned might be spread over five years. I am sure that such a sum would be a justifiable expenditure in regard to a national property which is reasonably valued at millions of pounds.

Size.—It attains a height of 100 to 150 feet, and a maximum diameter of 6 to 8 feet. Mr. Forester Martin, of Gosford, gives the height of trees in his district at from 100 to 150 feet, and diameter at from 2½ to 4 feet. He adds, "The trees appear to be healthful, and the young trees make good growth. Very large trees are rarely sound at heart." Up to 10 feet in girth in the Glen Innes and Tenterfield districts.—(Mr. Forester Crowley.) The height of 150 feet for this tree is attained in some places in the county of Richmond, according to Mr. Forester Crowley.

Mr. Forester Rudder says that in his district its approximate height is about 140 or 150 feet, and its diameter about 3 feet, but that it not infrequently attains a height of 170 or 180 feet, with a diameter of 5 and even 6 feet, diameters of 4 or 5 feet being common.

Mr. Fawcett reported to Baron von Mueller (*Eucalyptographia*) that tallow-wood trees attained a height of 300 feet on the Richmond River, but I have not been able to confirm this. It is, of course, very easy to over-estimate the height of tall trees. I should be glad if correspondents would favour the Department with guaranteed measurements of the size of exceptionally large tallow-wood trees. We want (*a*) height from ground to top of highest branch, (*b*) height from ground to where lowest branch springs, (*c*) girth at 3 and 6 feet from ground respectively.

Very large trees are generally hollow, but, as a rule, those under 3½ feet in diameter are sound. This should be borne in mind, for trees are like men in that, after a period of maximum vigour and strength, they become less strong, and finally fall into decay.

Dr. Joseph Bancroft states that this valuable tree is protected by legislative enactment in Queensland from being cut by timber-getters.

Distribution.—It is generally supposed that the tallow-wood does not come further south than the Hastings River. The most southerly locality is, however, Cooranbong, 26 miles south of Newcastle. Mr. Forester Martin, of Gosford, says: "The only place in my district in which tallow-wood is to be found is an area of about 4,000 acres in the neighbourhood of Cooranbong. I believe that tallow-wood crops up again at Port Stephens, so that there is a gap between the two places where tallow-wood does not grow."

Trees frequently skip over extensive districts in this way. For instance, in the article on black-wood it was shown how in its distribution from south to north this tree entirely skips over the Sydney district."

Mr. Martin says: "The tallow-wood here grows in patches—is not plentiful. It appears to like well-sheltered, well-drained localities, such as banks and creeks, heads of gullies, and spurs of ranges. Soil here sandy loam, enriched with leaf-mould."

Mr. Forester Rudder, who is stationed at Booral, reports that tallow-wood occurs more or less all through his district, except on its higher elevations in its north-western parts; but it is most abundant between Bulladelah and Gooloongolook, and in the southern parts of the parish of Alfred, commencing about 14 miles in a northerly direction from Dungog. The best and largest timber is usually found in undulating, scrubby, forest country.

Tallow-wood extends from about 8 miles south of the Macleay River to about John's River, a distance of about 45 miles to the south; inland it extends about 10 miles. In abundance it is about next to blackbutt, giving an average of about two trees per acre, which are about 20 to 25 feet to the first branch.—(Forester G. R. Brown.)

On the watershed between the Blick's River and the Nymboida (practically about midway between Grafton and Armidale) is a magnificent forest of mature tallow-wood, with blackbutt and a little turpentine. This is a maiden forest, full of grand timber, but practically inaccessible under present circumstances, and with the poor local demand for hardwood. The get-out for timber of this forest would be along the range to the Long Flat, about 1½ mile from Perrett's (Tyringham).

Mr. Forester Pope, of Murwillumbah, writes:—Tallow-wood, with the exception of the common box, grows more abundantly in this district than, perhaps, any other eucalypt. It is found uniformly distributed through all forest land at about four trees to the acre. Other hardwoods are in patches, and favour certain spurs, but one never goes many yards in forest land without finding several tallow-wood trees.

Mr. Forester Crowley, of Casino, states that tallow-wood is found plentifully scattered all over the flat country in the county of Richmond; it is also growing in a few places in the counties of Rous, Drake, and Buller.

Mr. Forester Deverell, of Glen Innes, states that it is found in all stages of growth on the eastern falls of Glen Innes and Tenterfield districts in fair quantities.

The notes on New South Wales localities for tallow-wood are supplemented by the following interesting tabular statement, which has been furnished by the Forest Department. Tallow-wood extends from Cooranbong, the most southerly locality in New South Wales, as already stated, to southern Queensland, being confined to the coast districts and tablelands.

In Queensland it is found in the forest near the Logan, Brisbane, and Pine Rivers.—(W. Hill.) A common tree on the hills of southern Queensland.—(F. M. Bailey.)

TALLOWWOOD (*Eucalyptus microcorys*).

No. of F.R.	County.	Area of F.R. in acres.	Class.	How distributed. No. of trees per acre.	How distributed. Over area of F.R.	Size Girth. ft.	Size Girth. in.	Quality.	Remarks.
1,120	Buller, Rous, and Drake...	80,788	A	3	10,000	6	6	Fair to good.	A fair growth generally of young tallowwood trees.
24	Clarence	2,500	A	1	500	6	0		
26	"	1,040	A	1	500	6	0		
243	"	7,600	C	6	2,000	7	0		
260	"	71	C	2	20	7	6		
353	"	4,480	C	2	1,000	6	0		
979	"	740	A	1	979	7	0		
1,101	Clarence and Richmond...	19.016	A	1	4,000	6	0		
1,662	Clarke	44,900	C	4	1.000	6	0		
537	Drake	38,400	C	2	2,900	7	6		
6,264	"	9,005	A	5	9,005	12	0		
112	Dudley	2,453	A	2	1,000	7	0		
158	"	79.680	C	3	35,000	7	0		
3,753	"	16,000	C	1	2,000	8	6		
136	Fitzroy	12,440	A	1	6,000	8	0		
355	"	5 660	C	1	5,000	6	0		
642	"	30,043	C	1	5,000	7	6		
10,786	"	18,560	A	2	2,000	7	6		
46A	Gloucester	26,700	A	2	9,000	10	6		
1,608	Gresham	24,960	C	12	24,960	9	0		
1,433	Gough	12,800	A	10	1,000	9	0		
33	Macquarie	2,100	C	1	2,100	7	6		
34	"	10,000	A	2	6,000	10	6		
100	"	7,472	A	2	3,500	8	6		
144	"	12,262	A	1	12,262	10	6		
233	"	280	C	1	280	9	0		
234	"	610	A	1	610	9	0		
235	"	3,854	C	1	2,000	9	0		
46	Northumberland... ...	15,954	C	1	1,000	7	0		
70	"	33,186	C	1	2,000	7	0		
111	Raleigh	3,590	A	1	3,000	9	0		
121	"	15,904	A	1	8,000	7	6		
4,780	"	2,500	A	1	2,280	8	0		
10	Richmond...	1,100	A	1	900	6	0		
11	"	2,800	A	2	2,000	5	6		
12	"	4,800	A	1	2,800	7	8		
13	"	2,800	A	1	2,000	7	8		
625	"	3,900	C	1	3,000	7	6		
894	"	6,400	A	1	5,000	8	9		
1,137	"	12,610	C	2	8,000	7	6		
62	Rous	2,700	C	5	1,700	9	0	Faulty ..	
249	"	16,661	C	3	10.000	10	0	" ...	
258	"	1,280	C	2	1,000	10	0	Fair ...	
864	"	930	A	10	600	9	0	" ...	
4,353	"	7,701	C	3	14,000	10	6	" ...	

Eucalyptus microcorys, F. v. M.

"The Tallow Wood."

Propagation.—From seed. In the warmer coast districts of the Colony it flourishes exceedingly. It is, in fact, one of the most rapid growers of our eucalypts. It is certainly one of our timber-trees which must be considered in any national scheme of forest conservation. I would like to draw the attention of those who cultivate trees for ornamental purposes to the merits of the tallowwood. It springs up quickly, and has a shapely, umbrageous head of very neat foliage. It is many years before it begins to get gaunt and show itself a forest tree. It is a change after the everlasting camphors, *Tristanias* (*Lophostemon*), *Pittosporum*, and so forth. I have grown several of them, and have been instrumental in getting others to try them, and, I believe, they have always given satisfaction as a well-formed shade tree. I do not know of any drawback the tallowwood may possess for this purpose.

The *Tropical Agriculturist*, of Ceylon, quoting an Udapussellawa correspondent, says:—"Of all Australian trees introduced into Ceylon, the tree which has grown beyond all compare is *E. microcorys*. A specimen 8 years old was 5 feet 4 inches in girth, and tall in proportion."

TALLOW WOOD.

Reference to Plate (page 297).

A. Leaf showing venation (a little diagrammatic).
B. Flower buds.
C. A flower. (Notice that the outer stamens are without anthers.)
D. Fruits.

Eucalyptus microcorys, F. v. M.

(1653-94)

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The "Saffron"—or "False Star Thistle."

(*Kentrophyllum lanatum*, D. C. et Dub.)

A Noxious Weed which is Spreading.

By J. H. MAIDEN.

Other Vernacular Names.—As people usually call this "Star Thistle," I have simply prefixed the word "false" for a reason indicated below. Baron von Mueller proposes the name "Saffron Thistle" for it. It is, of course, open to the objection that it has nothing to do with saffron; its congener (*C. tinctorius*) is the well-known safflower of India, sometimes said to be used for adulterating saffron. But in adopting the name saffron thistle, I have taken into account the fact that in the illustrated work on thistles (by Baron von Mueller), issued by the kindred Department of Agriculture of another Colony, this name is employed, and it would be a convenience to adopt a uniform vernacular nomenclature for the pest. But whether the public of these two great Colonies will take the slightest notice of these benevolent efforts to save confusion, time alone will tell. My own opinion is that they won't, and having started to call it "Star Thistle," star thistle it will remain to the end of time. It is called "Chinese Thistle" in the Gunnedah district, and "Yellow Chinese Thistle" (to distinguish it from the "Pink Chinese Thistle," *Centaurea calcitrapa*) in the Grenfell district. But the Mongolians are not responsible for its introduction.

Botanical Name.—*Kentrophyllum*, *kentron*, a sharp point, *phyllon*, a leaf, in allusion to the prickly leaves; *lanatum*, woolly (referred to below).

Synonym.—*Carthamus lanatus*, Linn. By many authors at the present day (notably Bentham and Hooker, *Genera Plantarum*), *Kentrophyllum* is included under *Carthamus*, of which the best known species is *C. tinctorius*, the safflower of India.

Following is the earliest record I can find of the Saffron or False Star Thistle in Australia:—"Woolly Kentrophyllum (*Kentrophyllum lanatum*, D.C.), a native of the Mediterranean coast; a great nuisance. It is of modern introduction. Cattle and sheep do not eat the plant, and its extension becomes very rapid, especially in the north and south. In 1887, the Legislature passed an Act for preventing the further spread of this thistle, but which was then erroneously thought to be the true Star Thistle, *Centaurea calcitrapa*. The further spread of the true Star Thistle should also be prevented." (Schomburgk, *Annual Report Botanic Gardens, Adelaide*, 1888, p. 23.)

The South Australian Act referred to is No. 409, assented to 9th December, 1887, and its title is "An Act for amending the Act No. 26 of 1862, and for preventing the further spread of the Star Thistle."

Mr. Albert Molineux, General Secretary of the Agricultural Bureau of South Australia, says of it: "*K. lanatum* is eaten to some extent by stock, and it might make ensilage; it is not worse than *Onopordon acanthium* (true Scotch thistle)." I hope, however, this will not convey the impression that it is anything but a real nuisance.

"*Star Thistle as Fodder.*—Mr. Magarey, Narracoorte Branch, Agricultural Bureau, S.A., noticed a query in the report of the Burra Branch in the Journal for April as to whether star thistles had ever been utilised as food for any animal, reported that he had mown and cocked a large quantity during the dry weather; that he had left it in cock till the rains came, when the sheep took to it, and have now eaten nearly all of it, and which leads him to believe that it would make excellent silage. The Chairman stated that from observations he believed that the seed would be very suitable for poultry." (*Journal Bureau Agric.*, S.A., i, 61, July, 1890).

This is a meritorious attempt to utilise a weed-pest, which, I regret, is so abundant in the sister colony. I would, however, recommend that uncompromising war be waged against it; that it be destroyed utterly. In cocking and carrying there is great danger of the seeds flying about and infecting clean land.

In Victoria there is in force a lengthy Act "To consolidate the law relating to the Eradication of Thistles," No. MCXLV, 10th July, 1890. Clause 3 gives a list of the thistles and allied plants included in its operation, but *Kentrophyllum lanatum* is not included in the list. It is, however, described and figured in the "Illustrated Description of Thistles, &c., included within the Thistle Act of 1890" (Department of Agriculture, Melbourne, 1893), so it has presumably been proclaimed a thistle under clause 3 of "An Act to amend the Thistle Act, 1890" (No. 1,337, 6th November, 1893). Land-owners, lessees, or occupiers are, under these Acts, to destroy thistles under a penalty not exceeding twenty pounds.

Popular Description.—A prickly plant, growing in bushy masses, and attaining a height of 2 or 3 feet. The flowers are yellow, and are surrounded with prickly clasping leaves almost of the same shape as those which clasp the stem. The stem is a little furrowed and, in this Colony, usually more or less silvery in appearance; plants growing in Europe are greener. The plant, particularly the upper portions of it, is more or less thinly-woolly, or rather spider-webby. Perhaps these few notes will supplement the plate in making the identity of the thistle clear to every farmer.

Botanical Description.—A botanical description will only be understood by botanists, and is perhaps unnecessary here. Those who desire the original description will find it in De Candolle's *Prodromus*, vol. vi, p. 610 (1837), while a botanical description in English will be found at page 17 of Baron von Mueller's *Illustrated Description of Thistles*, Melbourne, 1893.

In Moloney's "Sketch of the Forestry of West Africa," p. 376, I find under *Carthamus lanatus*, "Blessed Thistle" of the Parisians, said to possess sudorific, febrifuge and anthelmintic properties, Mérat et Sens, *Dictionnaire Médicale*, tome ii. p. 115. "Widely cultivated." The last statement is apparently taken from Oliver's "Flora of Tropical Africa," vol. iii, p. 439. Why it is "widely cultivated" I do not know. It may be that the seeds yield oil. It is closely related to the Safflower (*Carthamus tinctorius*), but contains very much less colouring matter. But I recommend Australians not to attach the slightest commercial importance to the supposed medicinal or tinctorial properties of our wretched *Kentrophyllum*.

How to get rid of it.—It is an annual, and the only way to get rid of it is to cut it before it comes into full flower, and then burn it. Landowners should not be content with cutting it, as the dried plant may lame or otherwise injure sheep, &c., and a few seeds may escape destruction. It is manifest that united action should take place in dealing with the pest, for if there be an infested paddock in a district, the wind will waft the seeds like little shuttlecocks into the surrounding land. The pest is not yet so prevalent in this Colony as it is in South Australia and Victoria, and it is to be hoped that landowners will eradicate it on the principle that "a stitch in time saves nine."

Where found.—This plant is a native of the Mediterranean region (Europe and Africa, and South West Asia). It has found its way into most temperate and warm regions of the world.

As regards this Colony, the Secretary of the Albury Pastures and Stock Board reports: "The star thistle is all over the district in patches."

Mr. Forester Harris sends it from Gunnedah, saying: "It grows in bushes to the height of about 3 feet, with a diameter of about 5 feet, and is spreading rapidly. On ground that this bush covers no grass will grow."

It has also been reported by Mr. Forester Postlethwaite from Grenfell, and I have received it from other parts of the Colony.

Kentrophyllum lanatum, D'C. et Dub.

(RB 53-94)

"The Saffron Thistle or False Star Thistle"

Australian Sandarach.

By J. H. MAIDEN.

Introductory.—It is a matter of common observation that a number of raw vegetable products of more or less importance are going to waste in Australia, simply because our people are ignorant of their properties and value. I can hardly cite a better instance than that of Australian Sandarach. Here we have a product absolutely and entirely identical in chemical and physical properties with a well-known article in regular demand. The price of this article at London auction sales is shown by the figures I give below [*Appendix* A], while its cost in Sydney is very much enhanced; and yet we actually import from Algeria, *via* London, at this high price, what is common enough in parts of New South Wales, and to be had for the gathering. The trees from which this resin (for Sandarach is a resin), exudes are the well-known Cypress Pines of this Colony, some species of which are found in the coast districts and table-lands, but they are far more largely developed in the drier parts of the Colony.

The collection of Australian Sandarach is one of those minor industries which could be readily undertaken by a family of children. As the resin flowed from the Cypress Pines, it could be accumulated in clean dust-proof tins until a sufficient quantity was obtained to be sold to the local storekeeper, who would again sell to the wholesale chemist, or wholesale oil and colourman of Sydney. Sandarach is usually graded. There would be no difficulty in grading locally our local product, while any surplus available for export could be shipped without grading if found expedient.

I have no means of getting at the consumption of Sandarach in this Colony, but we ought to be able to supply the local demand and have a good surplus for export.

With these introductory remarks, I will give some further information in regard to Sandarach and Australian Sandarach, based upon a paper "On Australian and Tasmanian Sandarach," written by me and published in the Proceedings of the Royal Society of Tasmania in 1889. I do hope that educated men who may read what I have to say, and whose inclinations or duties carry them into districts where the native Cypress Pines grow, will take the trouble to encourage settlers and others to collect the product referred to.

Notes on Sandarach.—The Sandarach or gum juniper of commerce is the product of a *Callitris* (*quadrivalvis*), which grows in North Africa. The following summary of its uses is taken from Morel (*Pharm. Journ.* [3] viii, 1,024): "According to Gubler, the Arabs used it as a remedy against diar-

rhœa, and to lull pain in hæmorrhoids. The Chinese used one kind (*C. sinensis*) as a stimulant in the treatment of ulcers (as promoting the growth of flesh), as a deodoriser, and to preserve clothes from the attacks of insects. In Europe it is used very little in medicine. It is most frequently employed as an ingredient in varnish, to increase its hardness and glossiness. It is used also as a fumigant, and in powder ('pounce') to dust over paper from which the surface has been scraped, to prevent the ink from running. It rarely enters into the composition of plasters."

Ordinary Sandarach exudes naturally, but the practice in Northern Africa is to stimulate the flow, making incisions in the stem, particularly near the base, and this hint might be borne in mind by our people.

When our Cypress Pines are wounded, the resin exudes in an almost colourless, transparent condition. It has obviously high refractive power, and is much like ordinary pine resin in taste, smell, and outward appearance, when the latter is freshly exuding. This transparent appearance is preserved for a considerable time, the resin meantime darkening a little with age. Old samples possess a mealy appearance, but this is merely superficial. The origin of this appearance has been explained as follows in regard to *Sandarach*, and doubtless the simple explanation holds good here:—"The surface of the tears appears to be covered more or less with powder, but this character is not to be attributed, as alleged by Herlant (*Etude sur les produits résineux de la famille des conifères*, p. 38), to the friction of the fragments one against another, but as has been ascertained by a microscopical examination by Dr. Julius Wiesner (Die chemisch-technisch verwendte Gummiarten, *Harze und Balzame*, 1869, p. 129), to the unequal contraction of the resin while drying, resulting in a mass of fissures that form, as in the case of several kinds of copal, facets that gradually separate from the mass and constitute the 'powder' of many authors." (Morel, *op. cit.*) Evidence against Herlant's supposition is also found in the fact that resins of the *Sandarach* class are nearly *white on the trees* after they have been exuded some little time, showing that the appearance is brought about by exposure to the weather.

Australian Sandarach.—Australian Sandarach burns readily, and on the Snowy River (near the Victorian border) it is often mixed with fat by the settlers to make candles. The aborigines used frequently to use it for a similar purpose. Sir Thomas Mitchell (*Three Expeditions*, ii, 37) says: "Each carried a burning torch of the resinous bark of the *Callitris*, with the blaze of which these natives (Lachlan) seemed to keep their dripping bodies warm.

The *Callitris* resins soften slightly, but do not melt in boiling water, and a sample of commercial Sandarach behaves similarly. In the mouth they feel gritty to the teeth, and in no way different to Sandarach. When freshly exuded they are very irritating to a cut.

I will reiterate, at this place, in order to save time, that the properties of Sandarach are shared by Australian Sandarach; I do not know in what respect they differ, and the one article may be substituted for the other.

It was a specimen of resin from the Oyster Bay Pine of Tasmania, sent to the Exhibition of 1851, which first drew the attention of experts to the possibilities of Australian Sandarach. For "the fine pale resin of the Oyster Bay Pine (*Callitris australis*) from the eastern coast of Van Diemen's Land" and other gums and resins, Mr. J. Milligan was awarded honorable mention (*Jury Reports*, 1851 *Exhibition*, p. 182).

I have only alluded to naturally growing trees, but Baron von Mueller states, "Probably it would be more profitable to devote sandy desert land,

which could not be brought under irrigation, to the culture of the Sandarach Cypresses than to pastoral purposes, but boring beetles must be kept off." Of course Cypress Pine timber is very valuable, as it is ornamental, and one of the best of our timbers to resist white ants, but I propose to confine myself to the resin in this paper.

The various kinds of Cypress Pines.—Our Cypress Pines all belong to the natural order Coniferæ (Cone-bearers), and are therefore allied to the Pines, Firs, Spruces, &c., of the Northern Hemisphere. They belong to the genus *Callitris*, which is mainly a synonym of *Frenela*. [The word *Callitris* is from the Greek *Kallos*, beautiful, in allusion to the appearance of the trees. *Frenela* is in honor of M. Frenel, a former member of the French Academy.]

In the Australian Colonies there are twelve species of *Callitris*, and some of them have varieties more or less marked, so that there are a goodly number of Australian Cypress Pines. Four of the species (*Roei*, *Drummondii*, *Actinostrobus* and *acuminata*), are confined to Western Australia, and have, of course, but a limited interest to us in the eastern colonies. *C. oblonga* is only found in Tasmania.

The Cypress Pines that are found in New South Wales, and which therefore especially interest us, are seven, namely:—

1. *Callitris Macleayana.* "Port Macquarie Pine," an elegant species now often seen in gardens.

2. *C. Parlalorei.* "Mountain Cypress Pine." "Stringybark Pine." These two species are closely allied, and are both found in the North Coast districts. They are not as abundant nor do they yield Sandarach as freely as the other species.

3. *C. verrucosa.* The "White or Common Pine;" often known simply as "Pine" or "Cypress Pine," but also as "Mallee Pine," "Rock Pine," &c. Well known under its name of "Murray Pine." It is the most widely diffused of all the Cypress Pines, being found in every one of the mainland colonies. It is easily known by its rather ornamental warted cones.

4. *C. columellaris.* This is usually known as "Cypress Pine," and it attains a great size. It appears to be confined to the coast districts and moderate elevations of Northern New South Wales and Southern Queensland.

5. *C. Muelleri.*—"Baron Mueller's Cypress Pine," "Mountain Pine." This species is often very ornamental. Its range does not appear, at present, to be very well defined. I have collected it at Middle Harbour, Port Jackson, and in the Blue Mountains (Mount Victoria). It has been sent to me from the Illawarra. Mr. Baker has collected it at Rylstone in the Mudgee district.

6. *C. cupressiformis.*—Perhaps better known by its synonym of *rhomboidea.* This pine I believe to have been a good deal confused (in New South Wales) with the preceding. Of course the cones are quite different. It is usually simply known as "Pine" or "Cypress Pine." It is extensively diffused in the coastal districts.

7. *C. calcarata.*—Better known under its synonym of *Frenela Endlicheri.* Everybody knows it under its name of "Red or Black Pine," whose timber is so largely used in the western parts of the Colony where white ants are prevalent. I need not further allude to the species here.

Of the above, *C. verrucosa* and *C. calcarata* will be found by far the most important from a commercial point of view, but the others all produce excellent sandarach.

Experiments on some Australian Sandarach of varying quality from various species.

Having learnt what sandarach is, and what Australian trees produce it, the following notes of observations and of incomplete experiments on definite Australian sandarachs will be interesting. To push the experiments further than I have done, would be more of scientific than of economic interest.

My experiments tend to show this:—Given similar circumstances in regard to size and age of tree, season of flow, climatic conditions, &c., the sandarachs from all the species are precisely similar in chemical and physical properties. Conversely it follows, that if two specimens of sandarach are of different qualities, the explanation is to be found in the circumstances above enumerated. What is the best season to collect sandarach or to bleed trees in a particular district, is only to be learnt by experience, and I think I have said enough to show that it is worth the trouble to try and find out.

Callitris verrucosa, R. Br. (Syn. *Frenela robusta*, A. Cunn).—A sample of "Murray Pine" resin from Quiedong, near Bombala, has a pale bleached appearance, much lighter than ordinary sandarach. Externally it has a very mealy appearance. Water has no effect on it. In rectified spirit, it almost wholly dissolves, leaving a little whitish resinoid substance. Petroleum spirit dissolves 5 per cent. of a perfect colourless and transparent resin.

Speaking of "Mountain Cypress Pine" or "Desert Pine" (*C. verrucosa*), the Catalogue of Victorian Exhibits, Colonial and Indian Exhibition, 1886, states, "A sandarach in larger tears than ordinary sandarach is yielded by this species. It yields it in considerable abundance, 8 or 10 oz. being frequently found at the foot of a single tree, but although this exudes naturally, the supply is stimulated by incisions."

"It is a transparent, colourless, or pale yellow body, fragrant and friable, fusing at a moderate temperature, and burning with a large smoky flame; very soluable in alcohol and the essential oils, and almost totally so in ether; turpentine at the ordinary temperature does not act upon it, nor do the drying oils, but it may be made to combine with these solvents by previous fusion." (*Report on Indigenous Vegetable Substance, Victorian Exhibition*, 1861).

This resin was used to make firm the union (after lashing) of the hardwood head to the reed in the making of reed-spears by the aborigines of Victoria. The resin was called by them Bij-jin-ne. (Brough Smyth, *Aborigines of Victoria*, i. 306).

A sample of New South Wales resin of this species is of a dark amber colour, and, externally, possesses the dulled appearance found on lumps of amber. It is the darkest specimen of an Australian Sandarach hitherto examined by me. It almost wholly dissolves in rectified spirit, yielding a bright yellow liquid: leaving 2·5 per cent. of insoluble residue. Petroleum spirit removes 22·8 per cent. of a clear resin when the original substance is digested in it.

Callitris verrucosa, R. Br. (Syn.: *C. Preissii*, Miq. partly).—The following note by Dr. Julius Morel (*Pharm. Journ.* [3], viii, 1025) in regard to a specimen of South Australian resin, is interesting. "With Sandarach resin may be connected another resinous substance, which was exhibited in the Paris Exhibition of 1867 from South Australia under the name of "Pine Gum." It is the resin of *Callitris Preissii*, Miq. The product resembles Sandarach, and might become an important article of commerce. . . . This resinous substance occurs in the form of slightly yellowish tears, thicker and

longer than those of ordinary Sandarach. In consequence of unequal contraction it presents, like Sandarach, numerous facets: and, consequently, the surface appears to be covered with a white powder. In its transparency and hardness the resin corresponds to Sandarach. Its odour is very agreeable and balsamic, and the taste is bitter and balsamic."

Callitris columellaris, F. v. M. (Syn.: *Frenela robusta*, A. Cunn: var. *microcarpa*, Benth.).—A sample of resin from this species dissolves almost entirely in rectified spirit, forming a pale yellow solution. The insoluble residue amounts to 4·6 per cent. Petroleum spirit, when digested on the resin, removes no less than 35·8 per cent. of a transparent, colourless resin. This is a remarkable percentage, and it would be interesting to enquire whether Australian Sandarach becomes increasingly soluble in that menstruum by age. An ordinary sample of commercial Sandarach yielded 8·9 per cent. to petroleum spirit.

Callitris cupressiformis, Vent.: "The Oyster Bay Pine of Tasmania," partly.—This is the pine already referred to, and a brief account of the resin has been copied into many of the text-books. I have collected resin of this species from Port Jackson, clear and transparent as water. It turns pale amber coloured if placed in a bottle, but its brilliancy shows no sign of diminution in that time. The Sydney trees readily exude their resin on slightly wounding, and the same remarks apply to the Tasmanian.

Callitris calcarata, R. Br. (Syn.: *Frenela Endlicheri*, Parlat).—A sample of Red Pine resin from the Lachlan River has freshly exuded, and has the colour and appearance of best selected Sandarach. Rectified spirit nearly wholly dissolves it, forming a beautifully clear slightly-yellowish liquid, with 1·3 per cent. of residue. Petroleum spirit extracts 22·1 per cent. of an apparently perfectly colourless and transparent resin.

APPENDIX A.

Gum Sandarach.

London, 11th May, 1892.—The market is very dull. At auction sale last Thursday a few packages sold, without reserve, at 59s. 6d. to 61s. for fair palish gum.

London, 16th September, 1893.—Sold cheaply to-day at a decline of about 3s. to 4s. for a parcel of 13 casks, offered without reserve; it brought from 72s. to 74s. per cwt.

London, 14th Oct., 1893.—A parcel of 12 casks sold cheaply, without reserve, at 65s. per cwt.; one lot realising 1s. more.

London, 25th Nov., 1893.—Nineteen casks sold very cheaply to-day; ordinary dirty and dusty at 48s. 6d., medium quality at from 64s., rising to 69s. per cwt.

London, 3rd March, 1894.—Seven casks, mostly oil damaged, sold, without reserve, with fair competition, at 41s. to 56s. per cwt.

The latest London quotation of a wholesale London firm is 125s. per cwt

Botanical Notes.

FRUIT OF CRYPTOCARYA MEISSNERI (F. v. M.)

THE fruit of this tree was hitherto unknown to science until Mr. Forester Brown, of Port Macquarie, recently sent it to the Department. The fruits (or fruiting perianths) are ovoid, usually pointed at both ends, and up to threequarters of an inch long.

NEW LOCALITY FOR CRYPTOCARYA PATENTINERVIS (F. v M.)

THIS small tree, only known from the Hastings to the Tweed Rivers, has been sent from as far south as the Upper Williams River, county of Gloucester. Mr. Forester Rudder, who sent it, describes his plant as 30 feet high, and with a trunk 3 inches in diameter.

NEW LOCALITY FOR PROSTANTHERA EMPETRIFOLIA (R. BR.)

MR. AUGUSTUS RUDDER has also sent to the Department a specimen of *Prostanthera empetrifolia*, from Booral. The leaves of his specimen are mostly an inch long, the usual length being about half-an-inch, but the find is chiefly interesting from the fact that the plant was not previously recorded from the northern districts. It was hitherto known from Port Jackson and the Blue Mountains. We have a great deal to learn yet of the range of our native plants.

AN INDIGENOUS PLANT (*Hydrocotyle asiatica*, Linn.) POSSESSING MEDICINAL PROPERTIES.

Hydrocotyle asiatica is a creeping plant with roundish or kidney shaped, bright green leaves, and inconspicuous flowers. One at least of its congeners (*H. laxiflora*), has an abominable fæcal smell, and is ironically known as "Native Mignonette." *H. asiatica* is found in moist places in many parts of the Colony. In the coast districts, and particularly near the northern rivers and table-lands where there is rich soil, it grows in the greatest profusion, covering the ground for large areas with a carpet of bright green. It is also found in New Zealand, the Pacific Islands, and tropical and sub-tropical Asia, Africa, and America. It belongs to the natural order *Umbelliferæ*.

Mr. G. M. M'Keown, Manager of the Experimental Farm at Wollongbar, Richmond River, recently sent this plant to the Department, stating that it is "credited locally as valuable when applied to wounds or sores in the form of a salve or poultice."

This is the first occasion on which I have heard of it being put to use in New South Wales, but it is a well-known remedy in India, having been in use amongst the natives for many centuries. It is officinal in the Pharmacopœia of India (Waring, 1868, p. 107). From that work the following particulars are obtained:—

Official part.—The leaves. In the fresh state they have little or no smell, but when bruised they exhale a peculiar aromatic odour; taste pungent, bitter and disagreeable.

Active principle.—A pale-coloured, pungent, bitter volatile oil, named *vellarine.* The dried leaves are not distinguished by any remarkable odour or taste.

Properties.—Alterative tonic; locally applied, stimulant.

Therapeutic uses.—In anæsthetic leprosy good results have followed its use, but it possesses no claim to the character of a specific attributed to it by some. It has been found more useful in secondary or constitutional syphilis, especially in those cases where the skin and subjacent cellular tissue are principally affected. In non-specific ulcerations, and in skin diseases, it is of value both as an internal and as a local remedy.

Preparations.—Powder of Hydrocotyle. Take of freshly gathered hydrocotyle leaves a sufficiency; remove the stalks, and dry thoroughly by exposure to the open air in the shade at a moderate temperature; when thoroughly dry, reduce to fine powder, and transfer to well stoppered bottles. [Thirty pounds of the fresh leaves prepared in this manner, yield between 3 lb. and 4 lb. of the powder, which is of a pale-green colour, and slight but pleasant aroma. Solar and a high artificial heat are objectionable, as they cause the dissipation of the volatile oil, on which the activity of the leaves depends].

Dose.—From 5 to 8 grains daily. Sprinkled on alcerated surfaces, it stimulates them to healthy action.

Hydrocotyle Poultice.—Take of fresh leaves of hydrocotyle a sufficiency; bruise and moisten with cold water.
A valuable stimulant application to various forms of ulceration.

The Pharmacographia indica, ii, 107 (1891), confirms the above estimate of the therapeutic value of the drug, and also states that it is so abundant in the Mauritius that it serves as forage for cattle, whose milk it improves; it is also greedily eaten by pigs and other domestic animals. It is the more desirable to draw attention to an indigenous medicinal plant, as we have so few that, in the present state of our knowledge, possess undoubtedly valuable properties. In the bush it will be most convenient to employ the plant in the manner and for the uses indicated in Mr. M'Keown's note.

The Barnyard Grass (*Panicum crus-galli*, Linn.).

Within the last few months this one grass has been perhaps as frequently sent to the Department as all other grasses put together. It has been sent from Goulburn, Kanimbla Valley, Carcoar, Forbes, Dripstone (somewhere out west, but I don't know exactly where), Parkes, Armidale, Albury, and other localities of which I have kept no record.

It may also be found in almost every suburb of Sydney, usually at the edges of roads which have not been kerbed and guttered, generally in damp places, and sometimes actually growing in water. It often appears in freshly broken up land, rubbish heaps, &c.

Although a recent introduction into many of the localities in which it is now found, it is a real Australian native, although it is also found in many parts of the world.

So that it is by no means confined to the coast districts. What is the explanation of its appearance in so many places during the same season can perhaps only be guessed at, and it really does not very much matter. It may have been distributed in seed sent by a Sydney house.

All who express any opinion in regard to it are loud in its praises as a nutritious grass, which produces an enormous quantity of feed. It seeds sometimes at a foot high, but usually it is a much larger plant, attaining a height of 6 feet and even more. A figure of the grass will be found in the *Gazette* for April, 1891.

The late Dr. George Vascy, in "The Agricultural Grasses of the United States," says of the Barnyard Grass:—"In the northern states it is esteemed as a rough coarse weed; in the south it is often utilised and considered a very useful grass." He quotes Dr. Charles Mohe, of Mobile, Alabama, who says:—"It grows luxuriantly, particularly in the lowlands of the coast, is greedily eaten by horses and cattle, and makes a hay of good quality. It is justly regarded as an excellent grass, particularly before it ripens its seed, as in the latter stages of its growth the long and stiff awns of its spikes tend to make it somewhat unpalatable." He also quotes Professor Phares, of Mississippi, who says:—"In Louisiana, Mississippi, and some other states it is mowed annually. Some farmers assure me that they harvest four or five tons of hay per acre. It may be cut twice each season by making the first mowing as soon as it begins to bloom. I know no one who plants it; but it annually re-seeds the ground and requires no cultivation or other care, save protection from live stock and the labour of harvesting. Being a coarse grass, with long leaves and large succulent stems, it requires care to make into hay. In one county in Mississippi, hundreds of acres are annually mowed on single farms. Cows and horses are very fond of it whether green or dry. Farmers who have tested it most thoroughly for many years prefer it to the best corn fodder."

Here is a Canadian opinion of it. "A tall coarse grass producing a great quantity of succulent feed, which is highly relished by stock. It grows in low land and around dwellings throughout the country. In the early stages of growth it is excellent and nutritious feed; but as it reaches maturity, in common with most grasses, deteriorates rapidly, indeed somewhat more rapidly than any other." (Fletcher, *Bulletin* No. 19, *Central Experimental Farm, Ottawa.*)

Mr. Fletcher also gives an analysis of a Canadian specimen of this grass. The sample selected was in flower. Following is its percentage composition:—

	In fresh or green substance.	Calculated to water free substance.
Water	85·30	....
Ash	1·64	11·16
Protein (albuminoids)	2·02	13·75
Fibre	4·48	31·09
Nitrogen free extract (carbo-hydrates)	6·25	41·87
Ether extract (fat)	·31	2·13
	100·00	100·00

It will be interesting to compare these analyses with those of three samples of grass of American growth, as quoted in Dr. Vasey's work.

	In fresh or green substance.			Calculated to water free substance.		
	1.	2.	3.	1.	2.	3.
Water*	14·30	14·30	14·30	......	......	......
Ash	5·98	13·37	10·13	6 98	16·07	11·82
Albuminoids	6·66	3·42	10·80	7·77	3·99	12·60
Fibre	24·78	26·68	21·69	28·91	31·13	25·32
Nitrogen free extract	46·44	40·08	40·95	54·19	46·77	47 77
Fat	1·84	1·75	2 15	2·15	2·04	2·49
	100·00	100·00	100·00	100 00	100·00	100·00

* These samples were, of course, very much drier than the Canadian sample.

The percentages of total nitrogen, or non-albuminoids, and of nitrogen as non-albuminoid substances, are also given, and at page 139 an analysis by Wolff of the ash of this grass is given, but it will be sufficient to quote where they are to be found. The other analyses quoted by Dr. Vasey are by Clifford Richardson.

Speaking generally, it may therefore be said that the grass arrives at its greatest perfection in moist warm localties; in colder climes it gives less satisfaction. I have shown that it will grow in many parts of our Colony, and I would recommend farmers to give every encouragement to it for horse and cattle feed. It is too coarse for sheep. An advantage of it is the freedom with which it seeds.

Apple Culture.

By ALBERT H. BENSON,
Fruit Expert.

CHAPTER I.

Origin of the Apple.

All the numerous cultivated varieties of the apple have been originally derived by cross-fertilization and natural selection from the Wild Crab of Europe—the *Pyrus Malus* of Linnæus—which is found growing wild over all the temperate regions of Europe and Western Asia, and is probably indigenous in England. We have no definite knowledge when the first improvement from the wild state occurred, but that the fruit is of very great antiquity we have every reason to believe, as it is mentioned by Homer, and is several times referred to by Roman writers. Many varieties were known to the Romans, and the fruit was held in high esteem by them. Besides the Wild Crab of Europe, several other species of Wild Crabs are known, of which one at least—the Siberian Crab (*Prunus prunifolia*)—has been introduced into our orchards; but they are of no importance when compared with the *Pyrus Malus*. The apple is undoubtedly the king of all the fruits of the temperate regions, and is more widely distributed and more universally used than any other cultivated fruit.

Uses of the Apple.

Unlike most other fruits, the apple is looked upon more as a necessary article of everyday use than as a mere fruit, and this is mainly on account of the many and varied uses to which it may be put. It is either used fresh for dessert, or it may be cooked in many different ways. It may also be dried and packed so that it will keep for years without deterioration, and may be sent to any part of the world. It makes an excellent jelly; in fact, a large proportion of the fruit jellies of commerce consist mainly of apple jelly flavoured and coloured with the fruit it is wished to represent. In the United States a common, excellent, and wholesome article of food, termed apple butter, is made by stewing pared and sliced sweet apples in new cider.

The expressed and fermented juice of the apple forms cider, and from sour cider a very good and wholesome vinegar can be made. Apples also enter largely into the manufacture of many sauces and chutneys, and when cooked, or if thoroughly ripened and used fresh, they are a wholesome and

nutritious article of food, as will be seen by reference to the following analysis of the whole fruit by the late Professor Church:—

Water	83·00
Albumen	0·40
Sugar	6·80
Malic acid	1·00
Pectose, pictin, and gum	5·20
Cellulose	3·20
Ash	0·40
Total	100·00

The quality of the apple determines its use. Thus apples for dessert should be of medium size and possess high flavour and quality; for cooking, however, a large, well-flavoured sub-acid fruit of medium texture is preferred, and in this Colony it is also necessary that a good cooking-apple, to be readily saleable, must have a green or greenish-yellow skin—though this is due to the ignorance of the buyers in not knowing the requirements that it is necessary for an apple to possess in order to render it a good cooker. The colour of the skin has nothing whatever to do with the quality of the fruit, some of the very best cooking varieties being of a very high colour, and the finest dessert apple in the world, the Green Newtown Pippin, as grown in the north-eastern States of America, is, as its name implies, a green apple. For cider, a soft-fleshed, juicy apple, having a sweet or somewhat acid, rough or bitter-sweet, though dense, juice is required.

For apple butter, a soft, sweet apple is best; and for drying, a large apple, having a firm, white flesh that will cook well, is preferable.

Districts for the Apple.

There is no part of New South Wales where the cultivation of the apple is not possible, though in some districts it is never likely to become profitable. If care is exercised in the selection of varieties, apples can be grown in the almost tropical northern rivers district, and also in the hottest and driest parts of the interior with proper care, the selection of suitable varieties, and the judicious use of water for irrigating; but it is mainly to the colder parts of the Colony—the different elevated table-lands—that we must look when we want to produce the best fruit.

The apple is essentially a fruit of the temperate regions, and in order to produce fruit of the finest quality it is necessary for the trees to undergo a winter rest in as nearly a dormant condition as possible, and it is this failure to obtain the necessary rest that renders the warmer coast districts of the Colony unsuitable for growing the finer varieties of long-keeping apples, or of producing an apple equal in flavour and texture and having as good keeping qualities as the same variety grown in a district where the tree undergoes a good rest, even though during the summer the temperature may be higher than that experienced in the coastal and more humid districts. The coastal districts, except the most northern, are however, well adapted for growing early and mid-season varieties, both for dessert and cooking, for local consumption, as the fruit is disposed of, in a great measure, before the fruit of the colder districts is ready for market, thus the two districts do not clash. The apple thrives remarkably in the coast districts, the tree-growth being very rapid, and the trees bearing early and heavily. This is essentially the case with apples of local origin, which are thoroughly adapted to local conditions, but many apples of foreign extraction do very well, and have become perfectly naturalised.

It is a very difficult matter to say where the best apples are grown in this Colony, as the districts that produce really good apples are numerous and widely separated from each other, and they are also very dissimilar in the character and quality of their soil; and again, certain districts produce certain kinds of apples to greater perfection than others. I have, however, received apples equal to anything produced either in the old or new world from the following districts:—New England, Orange, Molong, Bathurst, Goulburn, Breadalbane, Crookwell, Monaro, Yass, Moss Vale, Tumberumba, several parts of the Blue Mountains, and some splendid fruit from other and warmer districts, such as Tumut, Inverell, Albury, Deniliquin, Wagga Wagga, Narrandera, Bega, and from several parts of the counties of Cumberland, Camden, and Northumberland, so that it is easily seen that the profitable range of the apple is a very wide one in this Colony, and yet, instead of producing enough to supply our own wants, we are largely dependent on Tasmania for our supply of late-keeping varieties.

Soils for the Apple.

Although the apple will grow in almost any kind of soil, provided it possesses sufficient natural drainage, the best soil for the apple is a soft sandy loam of good depth, having a subsoil of clay, marl, loam, shale, or rock, but not gravel, and possessing good natural drainage, stagnant water round the roots of the trees rapidly proving fatal. The apple does not require too rich a soil, if quality and keeping properties are a consideration, and it will often thrive and produce heavy crops of good fruit on soils that are too poor to produce any other fruit to perfection, or to grow any farm crop profitably. No fruit makes a smaller call on the soil than the apple, as will be seen by reference to the following analysis of the ash of the fruit and of the tree, which I have obtained from Professor Wickson's work on "Californian Fruits, and how to grow them":—

	Apple Fruit.	Apple-tree.
Potash	35·68	19·24
Soda	26·09	0·45
Magnesia	8·75	7·46
Lime	4·08	63·60
Iron	1·40	0·07
Phosphoric acid ...	13·59	4·90
Sulphuric acid	6·09	3·29
Silicic acid	4·32	2·06

The total amount of ash in 1,000 lb. of fruit is 2·2 lb., and contains:—

Potash (K_2o), ·80 lb.

Phosphoric acid (P_2O_5), ·30 lb.

Nitrogen (N), ·60 lb.

In a crop of 20,000 lb. the following are the amounts of each of these substances extracted from the soil, which must be replaced by manuring if the soil requires it:—

K_2O — 16 lb., supplied by 32 lb. of sulphate of potash, containing 50 per cent. of K_2o.

P_2O_5 — 6 lb., supplied by 33 lb. of superphosphate, containing 18 per cent. of P_2O_5.

N — 12 lb., supplied by 60 lb. of sulphate of ammonia, containing 20 per cent. of N.

Propagation of the Apple.

The apple is easily propagated, either from seed, by budding or grafting the desired variety on to a suitable stock, or by means of cuttings or layers, though the latter methods are seldom resorted to. Propagation from the seed is entirely chance work, and is a very uncertain method of obtaining varieties true to the parent stock, on account of the prevalence of cross-fertilization; but it is by means of the seeds of apples that have been purposely or accidentally crossed that we obtain new varieties. The methods of propagation most commonly employed are root-grafting and budding, and these methods I will now describe in detail under the heading of

Stocks.

There are several stocks for the apple:—

1st. *The Seedling Apple Stock.*—This stock is used almost universally in England when standard trees are required. The seeds chosen are of strong and rapid growing varieties, and the stocks, when large enough, are worked over either by budding or grafting into the varieties that it is desired to propagate. The seedling stock, although it is a strong-growing stock, and makes the finest root system, is, however, not much used in this Colony on account of its tendency to blight (woolly aphis), but, occasionally, the seeds of blight-resistant varieties are planted for stocks, and answer very well.

2nd. *The Wild Crab Stock.*—This stock is not used in this Colony, and may, therefore, be left out of the question.

3rd. *Dwarfing Stocks.*—Two stocks are used for dwarfing—the English Paradise or Doucin, and the true or French Paradise, the latter being the better stock. Both these stocks are very susceptible to the attack of the woolly aphis, and, in consequence, they should never by any chance be placed below the surface of the ground, as they throw out roots readily, and these roots will very quickly become infested with blight. Dwarfing stocks should always be used in conjunction with blight-resistant stocks—never alone.

4th. *Blight-resistant Stocks.*—By blight-resistant stocks I mean a stock the roots of which are not attacked, or only slightly attacked, by the woolly aphis, so that when fighting this great pest the orchardist need not have to trouble about the roots of his trees, but can confine his attention to the parts of the tree aboveground. By experience it has been found that certain varieties of apples are very little affected by the woolly aphis under any conditions, and advantage has been taken of this knowledge to use these varieties for stocks, so as to minimise as far as possible the evil effects of the disease. Of these blight-resistant varieties two are commonly used for stocks—one, the Northern Spy, an American apple of a strong very upright habit of growth, and having a very fibrous root; the other, the Winter Majetin, a vigorous but more spreading tree, having long spreading roots. The Northern Spy root is often unsuitable for light sandy soils, being too fibrous, and not having a sufficiently firm hold of the ground, so that the trees are apt to be blown down by a heavy wind. In such soils the Winter Majetin root is preferable.

The usual method of propagating blight-proof stocks is as follows:—A small piece of the root of a blight-resistant apple, from three to four inches long and of the thickness of a lead pencil or larger, is obtained, and on to this root a graft of a blight-resistant apple is worked. The root and graft should

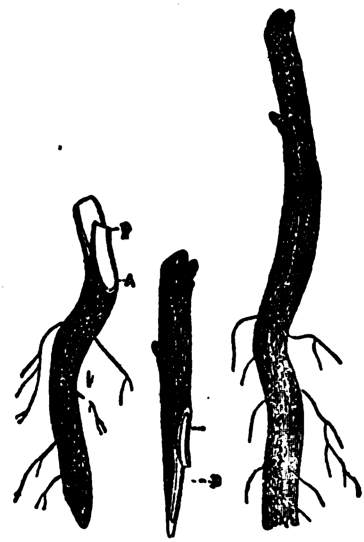


Fig. 1.—1. The root, showing sloping cut at *A*, and the tongue at *B*. 2. The scion, showing sloping cut at *A*, and the tongue at *B*. 3. The union of scion and stock ready for waxing.

be of as nearly the same size as possible, or the root if anything larger than the graft when the method employed is that of the root-splice graft.

When, however, the graft is larger than the root, or when there

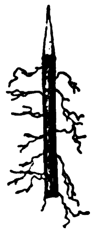


Fig. 2.—The Root.

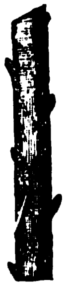


Fig. 3.—The Scion

Fig. 4.—Scion, with Root in position.

are a number of small roots available, then the method employed is that of the root-side graft, or roo[t] help as it may be termed.

Whichever of these methods is employed the grafts are carefully tie[d] with rafia or other tying material but not waxed, and are then planted out in the nursery row, where they are carefully attended to, only one bud of the graft being allowed to develop. The following winter or early spring they are worked over into the variety that it is desired to

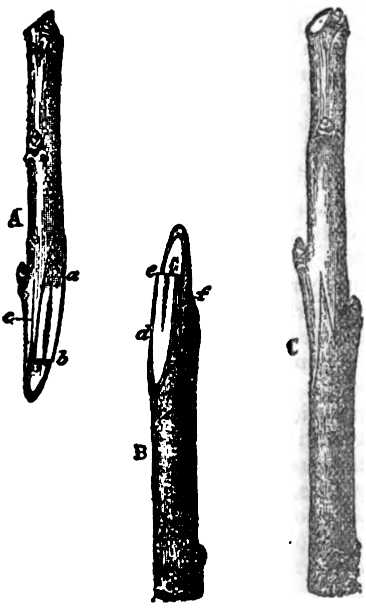


Fig. 5.—*A*. The scion. *a*. The sloping cut. *b*. The tongue. *c*. Shows thickness of tongue. *B*. The stock. *d*. The sloping cut in the stock. *e*. The tongue. *f*. Shows thickness of stock from the cut or tongue. *C*. The scion inserted, and ready for waxing.

propagate by means of grafting—this time by the ordinary splice or whip-graft, the graft being firmly tied and waxed. You have thus a doubly worked tree, of which the roots and lower part of the trunk are blight-resistant, and only the top is liable to blight. When it is desired to dwarf the trees, the Paradise stock is used, and in this case the stocks are first worked as described, but instead of working the desired variety direct on to the blight-resistant stock, a paradise graft is first worked on, and the year following the variety that it is wished to propagate is worked on to the paradise wood. You have thus a tree that has been worked three times—first, blight-resistant wood is worked on to a blight-resistant root; second, paradise wood is worked on to the blight-resistant wood; and, thirdly, the desired variety is worked on to the paradise. Budding may be employed in all cases in the place of grafting if desired, except in that of the first working—the blight-resistant wood on to blight-resistant root, when grafting only can be done. Full particulars of all the different methods of grafting as applicable to different sized stocks will be found by referring to the article on grafting which appeared in the September number of the *Gazette* for 1892.

Other stocks in addition to those mentioned have been used for the apple, but they are not of sufficient importance to take note of, and should never be used, for though the trees may grow, they will never thrive equally as well as those on the stocks that I have described.

Selection of Site.

In order to obtain the best results from the apple orchard it will always pay to select the most suitable situation that is obtainable, for though the apple will grow almost anywhere, yet under certain conditions it will do much better than under others not so favourable—generally speaking, a gentle slope to the north. North-east or north is to be preferred. Too steep a slope is not desirable, as the ground is apt to wash badly with heavy falls of rain, especially if it is kept in the high state of cultivation that is so necessary for successful culture—especially in the warmer and drier districts of the Colony. The general lie of the surrounding country should always be taken into consideration when selecting the site, and every advantage taken of the natural shelter that may exist. Cold, frosty hollows should always be avoided, owing to the possibility of injury to the blossoms from frost in such places. Open plain country, subject to heavy wind-storms, should also be avoided, but if no other site is available, then, before planting, the site should be surrounded with a good artificial shelter. Sound, well-drained land, not too rich, should also be chosen, and if the land is deficient in drainage then this want must be artificially supplied, as no matter how suitable the soil, climate, or situation, if there is not a perfect drainage the apple will not thrive. The trees may do very well for the first few years, but as soon as the roots penetrate down to the stagnant water the tree will show signs of failing and probably become diseased. Stagnant water round the roots sours the soil, scalds the fine fibrous roots, and tends to set up a generally unhealthy action of the tree's growth, which is the immediate cause of many of the diseases that affect the apple.

Drainage.

In my article on Orange Culture in the *Gazette*, September, 1893, I mentioned the best methods of drainage, and laid stress on the great necessity for carefully attending to this most important and often sadly neglected

operation, and I cannot do better than quote what I then stated as to th advantages to be derived from a good system of sub-drainage.

1st. The removal of stagnant water from around the roots of the trees and a general sweetening and warming of the soil.

2nd. A thorough aëration of the soil, which causes the process of th disintegration or breaking up of the soil to take place mor rapidly, thus rendering many of the inorganic constituents of th soil more readily available as plant food.

3rd. Increased facilities for working the land which is much kinder an more friable than undrained land, as after heavy rain one is enable to get on heavy land much sooner when drained than when un drained, which is of itself a very great consideration in the matte of keeping down weeds in seasons such as we are having.

4th. Increased facilities for the absorption of moisture by the soil, an thus rendering it better able to withstand drought than an undraine soil, having a smaller capacity for absorption.

Space will not permit my entering fully into the different methods of su drainage in this article, but I cannot let the opportunity pass without givin a few words of advice, and these are :—Do whatever drainage has to be don thoroughly, and do not put the drains too far apart or too deep; in stick retentive soils 20 feet apart and 30 inches deep is enough, as in such soi the drains will not draw further, but rather do a small acreage thoroughl than a large one indifferently, it will pay better and give far greater satis faction in the long run. Personally I am in favour of tile drains, as the last longer, do better work, never choke if properly laid, and the expense o digging the drains and laying the tiles is much less than in the case of ston slab, or sapling drains. The only advantage in these drains is that in mo cases the material is at hand and costs nothing except the labour, but if th has to be hired it will be cheaper and more satisfactory to drain with tile In draining with tiles it is false economy to use too small tiles—2 inches i diameter is the smallest that should be used under any circumstances, an only then when there is a short run and a good fall. Two and a half inc or 3-inch tiles are the best sizes for all branch drains. Main drains shoul be of 4-inch or 6-inch or even larger size, according to the area of land t be drained—length of main drains and fall.

Shelter.

A good shelter is always of the greatest importance in every orchard, bot as a protection from the wind-storms, which shake the fruit and break, spli and otherwise injure the trees, and also as a protection against the ho "northers" of the drier districts, which scald both the fruit and the foliage, an often cause a premature and unnatural ripening of the fruit. As previousl mentioned, when selecting the site advantage should always be taken of an existing shelter, such as a belt of timber, the natural lie of the land, or background of higher land to break the force of the prevailing winds, o the winds that are found by experience to do the most damage in th district. If there is no natural shelter or only a partial shelter, then it i necessary to provide an artificial one, and this is best done by planting double or treble row of shelter trees on all sides from which injury may b expected. There are many trees suitable for this purpose, as it is no necessary that they should be evergreens, and, therefore, trees valuable fo their fruits may be used, such as the olive, mulberry, walnut, chestnu

locust beans, pecans, or loquat for the coast; and if evergreens are wished, then some of the varieties of the pine, such as the *Pinus insignis* or *Pinus pinaster*, or the olive may be used.

The whitethorn or hawthorn is often used for shelter hedges, but this is by no means desirable, as some of the worst diseases of the apple attack the whitethorn as well. This is notably the case with the *Mytilaspis pomorum*—the apple-bark louse or mussel-shell scale, with which many thorn hedges are badly affected. As this insect is one of the most troublesome ones to eradicate, and does a great deal of harm both to the tree and fruit, any plant that is likely to form a shelter and breeding ground for it should be carefully excluded from the neighbourhood of the apple orchard.

Preparation of the Land.

Do this thoroughly. Remember that planting an apple orchard is not like planting a field of wheat. The orchard has to last a lifetime, whereas the wheat crop only occupies the land for a few months.

Extra care in the preparation of the land will always pay in the end, as the trees will get a better start, thrive better, come into bearing earlier, and produce more and better fruit than where no attention is given to the matter. Never plant the trees on raw unsweetened land if it can be possibly avoided. Always get the land thoroughly sweetened, and into a good state of tilth first, then plant, and the trees will go right ahead. It is better to lose a season, and let the land either lie idle or take a hay or grain crop off it, than to rush the trees into the soil when it is in a totally unfit condition to grow them. The loss of time by waiting will be more than made up by the increased vigour of the trees. After the land has been cleared, and the roots taken out to a depth of not less than 18 inches, it should be ploughed as deeply as the soil will permit, but on no consideration should the subsoil be brought to the surface. The ploughing should be supplemented by subsoiling to as great a depth as the subsoiler can be got to work, especially if the subsoil is at all of a sticky, heavy, or retentive nature, as it will be found to be of the greatest advantage, by improving its mechanical condition, and facilitating drainage by allowing the otherwise stagnant water to get more readily to the drains. When, however, the soil is of a deep, sandy, loamy nature, easily worked, and possessing good natural drainage, then subsoiling is not so necessary; and if the land is deeply ploughed and left exposed to the weather in as rough a state as possible for a month or two, then after receiving a good harrowing, it will be in excellent condition for planting.

Laying out the Orchard.

As I have just stated, an apple orchard once planted is likely to stand a considerable time, therefore it will pay to take a little extra care to set it out in such a manner that it may be a credit both to the owner and to the district. There is no prettier sight than a well-planted and well-cared-for orchard, but a badly-planted and neglected orchard is an eyesore to any intelligent fruitgrower. In planting out the orchard the trees should be symmetrically arranged, and the rows, no matter from what angle they are looked at, should be faultless. Correct planting, besides adding to the appearance of the orchard, is of the greatest assistance in the working of the ground, as the work can be done much more easily and expeditiously than when the trees are planted anyhow. When the horse or horses used for cultivation have to dodge about to get from one side of the orchard to the

other, as is too often the case in some of our older orchards, instead of being planted the trees seem to have been broadcasted. I have already given full particulars in the *Gazette* (see article on Prune Culture) of how to lay out an orchard correctly, and will refer those needing instructions to it; but I may say that in setting out an orchard, if you do not commence with a true base-line, and do not set your first side-line at an absolutely correct right angle to the base-line, then you will never get your trees straight; for though you may get them true two ways, the diagonal lines will be anything but straight.

Do not plant your trees too close together; they require plenty of room to produce the best results. Planting in squares at 25 feet apart each way is the least distance at which standard apple-trees should ever be set in this Colony, and 30 feet apart is often better. Possibly in some of our rich alluvial soil 35 fect apart each way may be found to be none too wide, as when the trees are given plenty of room the roots are not cramped, and the tops grow in proportion to the roots.

When planting trees so wide apart, other quick-growing and early-bearing trees may be planted between the trees that will eventually occupy the whole of the ground; and when the ground is becoming crowded these early-bearing trees may be cut out, and the whole ground devoted to the permanently-planted trees. This is best managed by planting in one of the following manners:—

1st. *The quincunx.*—Here we have a square of four trees, at right angles and equidistant from each other, with a tree planted exactly in the centre, just where two lines drawn diagonally from the opposite corners of the square would intersect.

When the trees become too crowded, the fifth or centre tree in each square is removed. [See drawing.]

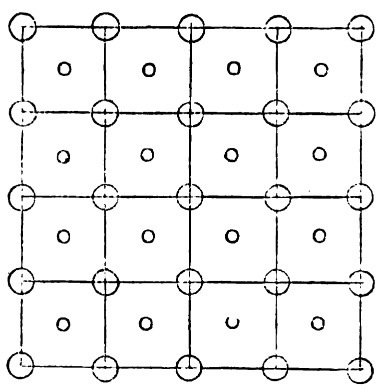


Fig. 6.—The Quincunx.

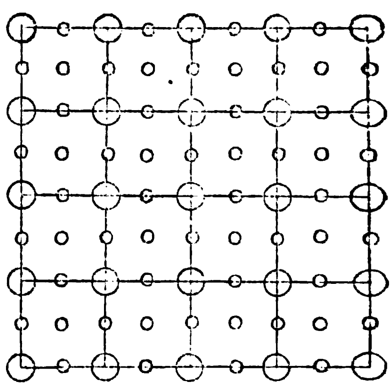


Fig. 7.—Alternating Squares.

2nd. *Alternating squares.*—Here we have the four permanent trees, forming the outer angles of four smaller squares; and when the ground becomes too crowded, all the trees excepting those that are to remain are removed. The manner in which this is done is easily seen by referring to the following drawing.

In planting dwarf trees the distance apart should not exceed 8 feet each way. But unless the orchardist is a skilled gardener I do not advocate the planting of dwarf trees, as the trees in this climate require constant care and attention, and a thorough knowledge of pruning, both root and top, to do well; but when they are in the hands of an expert, no trees will produce finer or higher-coloured fruit than a dwarf tree grown in the colder parts of the Colony.

What to Plant, and How to Plant.

As this article is intended to be more of a general guide for the ordinary fruitgrower and beginner than for the pomologist, I do not purpose going into the very vexed question of varieties at the present time, but will defer it to a series of articles at some future date, as it is far too comprehensive a matter to be treated in a general article—and will confine myself to a few general remarks. The first thing to bear in mind when planting out an orchard is not to plant too many varieties—the fewer varieties in season, provided that they are good ones and suited to the district, that are planted in an orchard the better it will pay. The planting of too many varieties, many of them of very doubtful value, is one of the greatest—if not the greatest—mistake our fruitgrowers have made in the past, and it has arisen from a desire to extend the selling season of each kind of fruit by means of a succession of different varieties over as long a period as possible. This has, no doubt, been of value in the past, but now, with the improved facilities for obtaining fruit from parts of the Colony other than the older fruit districts on which the market was then dependent,—it is necessary to grow only such fruits or kinds of fruit in each district as are best suited to the district, and can be produced to a greater perfection than in any other district. Thus, in the coast district we should only plant such varieties, whether for desert or cooking, that are in season before the later fruit of the colder districts is ready, and of the varieties that are suitable in this respect we should select none unless they show especial excellence in some respect; all others should be discarded. It costs just as much time, trouble, and expense to produce and market a case of inferior apples, that even at their best are a drug on the market, and hard to dispose of, as it does to produce and market a case of choice fruit which is readily saleable.

In the colder districts the apples grown should consist entirely of mid-season and late varieties, and only a few of the very best eating and cooking varieties, that are of proved excellence in the district, should be grown. Late keeping apples should be stored when grown, and there is no reason why we should not grow all that we require for our own consumption without having to depend on the imported Tasmanian article.

In choosing the trees from the nursery a yearling tree from 4 to 6 feet high without laterals is to be preferred; care being taken to see that it has a good root system, and that it has been worked on a blight resistant stock. Some growers prefer a two-year old tree, but in this case it should be carefully noted whether the tree has been properly headed back as a yearling. Before planting, the trees should be carefully examined, and all bruised or broken roots should be cut away, taking care to make the cut from the underside of the root, as young rootlets will then start from the cut surface.

Never set the trees too deep, the depth at which they were set in nursery is about the right depth to set them; more trees are ruined by too deep planting than by too shallow. In making the holes always see that the

centre is kept rather higher than the sides, so the drainage will tend to ru from the base of the tree not towards it. The following drawings show tree properly planted, and one improperly planted.

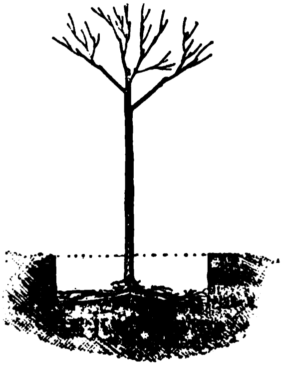


Fig. 8.

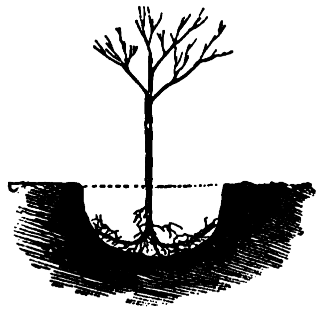


Fig. 9

In digging the holes the top soil should always be kept separate from th rest, and when the tree is set at the right depth, with the roots evenl distributed round the hole, then the fine top earth should be placed roun the roots firmly and evenly, so that every root comes in direct contact wit the earth and there are no hollow spaces. The hole is then filled up an the earth firmly placed, but not packed. No manure of any kind shoul be placed in the hole when the tree is planted.

Cutting Back at Planting.

If you want to get a strong symmetrical tree you must cut back at plantin The removal of the tree from the nursery has destroyed the greater portio of the fibrous roots of the tree, and in order for the top to correspond wit the reduced roots it must be cut back. The cutting back at planting is th first and most important step in the formation of the future tree, and th grower who neglects to do it prevents, in a great measure, the future vigorou development that takes place when the tree is properly started. When tree is planted out as received from the nursery without being cut back there are a large number of buds on it, most of which will start, and th energies of the tree will be divided between them, the consequence being th production of a number of weakly and useless branches; but when the tre is properly headed back, and only three, four, or five buds are allowed t develop and form the future head of the tree, then all the energies of th tree are concentrated on these buds, and the result is the production of three four, or five vigorous shoots just where they are wanted to form the futur main branches on which the tree is built, no matter what system of prunin you may wish to adopt.

In the case of the apple the tree should be headed back at 18 inches to feet high, taking care that the cut is made just above a strong bud. If th latter height is chosen, the buds that are to be left to form the future hea should be allowed to start at 12 inches, 18 inches, and 24 inche respectively, and should be evenly balanced or distributed round the stem Each limb will thus have a firm hold of the main trunk, and the tree will never split apart from the weight of the fruit. If it is found that no three

buds can be got that will form an even head, then four, or even five, must be left, but never more than five. Three limbs make a better tree than four, and four limbs make a better head than five.

Pruning.

For full particulars on pruning, I will refer to the article on this subject in the *Gazette*, and just give here what was then written as especially applicable in the case of the apple:—

"The manner of pruning described previously applies very well to the apple. It is best to plant yearling trees, and they may be headed back to from 15 to 24 inches, according to the idea of the grower. But, if headed at 24 inches, care should be taken to let the first branch come out at about 12 inches from the ground, and the other two, three, or four at regular intervals above it; as, as I previously explained, this makes a much stronger tree than if all the branches start from about the same spot. I have noted this objection in most of the apple-trees I have seen in the Colony, and also the fault of allowing too many main branches to start directly from the trunk. By doing so, one never gets as strong a tree as would have been obtained had it been pruned as I described. When apple-trees are of a close erect habit of growth, in pruning, always cut to an outer bud, as that will tend to spread the tree; and if the trees are of a naturally spreading habit, cut to an inner bud, which will tend to confine it and cause an upward growth. Even the most spreading tree, if properly pruned from the first, can be made to grow upright, and allow cultivation to be carried on right up to the trunk. The advantages of low heading apply to the apple as well as to other trees; and if the tree is started right, with a well-balanced head, and the branches well cut back to throw out strong laterals and strengthen themselves, and not allowed to crowd each other, you will have a tree come to bearing that will be strong and shapely, and that will carry its fruit within easy reach. Many apple-trees require little attention after they are once formed, but where branches several feet long are thrown out, they must always be shortened in; even a tree that has been started well would be spoilt if an excessive straggling growth were allowed to remain on. Care must be taken in warm districts not to prune apple-trees too much after they are shaped, for, as a rule, they require all the foliage they can grow to protect the tree and fruit from sunburn.

"The pinching of laterals, as previously recommended, is often of great value in the case of the apple, as the laterals are thereby converted into fruit-spurs, and the bulk of the crop of the tree is thus grown along the main limbs instead of towards the end of the branches, which is often the case with this fruit. Most apple-trees produce the greater portion of their fruit on two-year-old wood or on spurs, but in some cases most of the fruit is grown right at the end of the limbs, causing the tree to have a very straggling and untidy appearance, through the weight of the fruit bearing the limbs down."

Cultivation.

Keep the orchard clean—no orchardist can afford to grow a crop of weeds and a crop of fruit at the same time. If it is too much trouble to keep the orchard clean, then the best thing the owner can do is to quit growing fruit; he was not made for an orchardist, and should take up some easier line of work. Rest assured that if an orchard planted with the right varieties, in a suitable soil and district, does not pay when given thorough care and atten-

tion, and kept in the highest state of cultivation and free from all fungus pests—then a neglected, ill-pruned, ill-cultivated, and diseased orchard will stand a very poor chance, besides being a disgrace to the district and a propagating and disseminating ground for every kind of disease that fruit is subject to. Thorough cultivation is of the greatest importance to the orchard, as besides keeping the land clean and friable, it is the surest way of retaining moisture in the soil during a dry time. Where uncultivated land will dry right out and be perfectly unworkable, the same ground properly cultivated will retain all the moisture necessary for the trees' growth, and, what is more, should there be a shower at any time during the dry spell, the cultivated land will absorb and retain all the rain that falls, whereas the uncultivated land will absorb little, if any, the greater portion running off the surface and being lost. Every weed growing in an orchard in a dry time is robbing the trees of the water required for their proper development, so, therefore, if for no other reason, the orchard should be kept as clean as possible. Besides this, the growth of weeds and the accumulation of rubbish in an orchard forms the best of shelters for many injurious fruit pests, and renders it difficult to deal successfully with these pests.

Cultivating to retain moisture is best done by means of stirring the soil deeply, but not turning it over, so as to prevent the formation of the capillaries in the soil, thereby preventing in a great measure the loss of moisture by surface evaporation. By turning the land moisture is lost as the fresh surface exposed to the air rapidly dries out. The best implements for the summer cultivation of the orchard are the single and two horse cultivators, which are constructed for this especial purpose, and the disc and spading harrows. For winter work the plough is best, and any good American one or two horse plough with short stilts and having a short digging breast is suitable, and far preferable to the English style of plough. During the winter it is best to plough the orchard twice—once towards the trees and once from them—both ploughings the same way, not cross ploughing. If the land is of a heavy nature, then it is well to make the first ploughing towards the trees, turning the first few furrows next the trees shallow with a one-horse plough and finishing up with a two-horse plough, or, if a large orchard and gang ploughs are used, with a gang plough; in any case leaving the dead furrow midway between the rows of trees. The second ploughing the operation is reversed, the land being ploughed towards the centre, and the last furrow near the trees being ploughed out with a one-horse 8 or 9 inch plough, till all the ground is turned, and there is a small dead furrow at the line of trees. This can be easily managed if the trees are properly pruned, as described in my article on pruning, which I have previously alluded to, if the draft of the plough is blocked over so that the end of the short single-tree used does not come beyond the nose of the plough.

The beam of the plough and the handle that is next the trees can be wrapped up with sacks if wished, so that should the trees be struck by any chance there will be less likelihood of injuring them. The traces should also always be of leather, and the ends should be fastened to the back of the swingle-tree and pass over its ends, so if the swingle-tree should touch the trunk of the tree it will not do any great injury on account of the leather at the ends. By the use of a sideblock at the end of the plough-beam the horse can be kept out from the trees, and the plough worked right up to the trees as described.

By ploughing as described, instead of cross ploughing, the ground is kept level and even, and the soil does not tend to accumulate round the trees and bury the roots too deeply as is often the case where cross ploughing is

adopted. The next winter the ploughings should be done at right angles to that of the previous year, but both ploughings should be the same way—one towards and the other from the trees.

During the summer the ground should be kept constantly stirred, and the cultivator should always be used as soon after each rain as the land will work properly. If this is done a crust will be prevented from forming on the surface, and the moisture will be retained. All cultivation should be done, as far as possible, by means of horses—the work being performed cheaper, better, more thoroughly and expeditiously than it can possibly be by hand. Never do any work by hand that you can get a horse to do cheaper and better if you want to make fruitgrowing pay.

Manuring.

By referring to the analyses of the ash of the fruit and the ash of the wood of the apple previously given, it will be noted that the apple is by no means a gross feeder—the heaviest calls it makes on the soil being for lime for the wood, and potash and phosphates for the fruit—the total amount of manurial matter removed from the soil by a given weight of fruit being very much less than that of any other cultivated fruit, the quince excepted. Few soils, except the very poorest or a soil that is especially deficient in one of the essential plant foods, require much manure for apples; but if a manure is necessary, and this will be easily ascertained from the appearance and growth of the trees, if otherwise healthy, then it must be applied before the soil will produce a satisfactory return. Unless the soil is simply deficient in one of the essential plant foods—when the especial deficiency will have to be made good—the best manure to use is a general one containing all the elements of plant food, such as good farm-yard manure, but if this is not attainable, or it is not desirable to use it for fear of introducing weeds, such as sorrel, into the orchard, then boiling-down refuse, with the addition of a little kainit, makes a very good substitute, as its effects last a long time, as it only becomes slowly available for plant food. The best method of using boiling-down refuse is to form it into a compost with soil, or a mixture of soil, leaf-mould, or bush scrapings. The compost heap should be made by placing layers of the manure and soil alternately, and allowing it to remain for some months before using, taking care to keep it carefully covered from the rain. Previous to using, the compost heap should be turned over, and the whole thoroughly mixed. The best time to apply it would be during the late autumn or winter, so that the manure would be gradually becoming available for plant food, and be ready for the trees' use when the spring growth takes place. If the soil is deficient in lime, a manuring of a ton to the acre, applied in the autumn, will be required, but no other manure should be applied at the same time as the lime. Half a ton to the acre of boiling-down refuse composted into a ton and a half of compost, with 2 cwt. an acre of kainit added either to the compost, which is best, or applied by itself, should be sufficient for any soil, and such a dressing should last for three years, unless the trees are very large or the soil exceedingly poor, when the application will have to be made more frequently. The best way to apply the compost, if the trees are of any size, and the roots pretty well spread out, is to broadcast it over the whole ground, and cultivate or lightly plough it in. By the use of kainit all the magnesia required by the apple, which makes rather a heavy call on this substance, is supplied, as kainit contains, in addition to about 12½ % of potash (K_2O) about 12 % of magnesia (MgO).

(*To be continued.*)

Drainage.

By G. R. McMINN, C.E.,
Minto.

Why, How, and When we should Drain.

CONSIDERING the number of persons who, from time to time, have taken up the occupation of cultivating the soil, it is remarkable how few have given serious attention to that really most important matter, the underdrainage of their land. During the last few years, many, for want of other outlet for their capital and energies, have, without much previous knowledge, gone extensively into orchard and vineyard culture; and it is those more particularly that I would address in this article, although the remarks will apply equally well to those engaged in raising cereal or root crops. In fact, I may say there is no class of cultivation that is not benefited by good drainage.

Numerous able and very explicit articles on the subject "How to Drain," have frequently appeared in the various public prints devoted to agricultural matters, containing information of great value to those who were already convinced of the value and great benefits to be derived from well-drained land; but I have rarely seen any articles on "Why we should Drain," and it will be my endeavour, in as clear and concise a form as possible, to try and impress those who have not given much attention to the matter, with the great importance of the subject.

I may say, that having had very considerable experience in carrying out some of the most extensive drainage schemes in Australia, including areas of some hundreds of miles in extent, and having seen the marked benefits following such work—transforming worthless swamps where, previously, only noxious reptiles and wild fowl found a home, into waving cornfields and prosperous homesteads—it may be allowed that I can speak with some authority upon the subject.

In the first place, I would say that I do not agree with some writers who hold that all lands want draining. Some are so naturally drained by having a subsoil of such a porous character that water sinks in them by gravitation quite readily enough. It would be just as easy to take the "breeks off a Highland man" as to take water from such land by means of artificial drains. Rather, what such land requires is for the surface to be kept in as fine a tilth as possible to prevent evaporation. But on the other hand, we have very large areas of clay land more or less heavy—land, in fact, that with only a moderate rainfall will, in a short space of time, become super-saturated with water which cannot escape in any other way than by evaporation or flowing over the surface, either of which is most objectionable.

In conversation with many cultivators, I have ascertained that they had an idea that because our climate was at times very dry, there was no great

need for drainage. Nothing could be more erroneous, for it has been found, by long experience, that for the proper disintegration of the soil so as to allow the plant-roots to penetrate to a depth to obtain a necessary supply of food and remain in a healthy condition, that an effective system of underdrainage is absolutely necessary; as also, by this means, to get rid of all superfluous water in as speedy a manner as possible. Underdrainage has the effect of making the soil much more friable and mellow, and the working of it becomes a pleasure instead of an irksome toil, as is often the case. Indeed, I have seen many undrained places where the soil had become so packed after heavy rains, that the labour of cultivating it was almost as great as it was to break it up in the first instance. Then again, land that is drained can be operated upon in a very short time even after the heaviest rain, whereas weeks will sometimes elapse on undrained land before any work can be done, and during which time the water lying in the ground is doing very serious mischief, especially where orchards and vineyards are concerned, for the young rootlets, which should be always growing and gathering nourishment for the tree, will be completely destroyed by rot, and the result is seen by a paucity of foliage or an inferior and deficient fruit-crop; and the majority of the young wood sprays, that should be developing to carry the next year's crop, die off. The health of the tree is impaired, and unless remedial measures are speedily taken it soon dies, a victim to cold and wet.

Throughout the Colony thousands of trees are annually lost in this way. Neither do trees ever attain their full size on undrained land, even where its demands are not great; consequently one must never expect to get the best obtainable returns without drainage. Then, for comparison sake, visit an orchard that has been intelligently treated in the matter of drainage. See the luxuriant growth, the wide-spreading nature of the trees, and, above all, in due season, the large crop and fine development of luscious fruit, and conviction as to what is necessary to be done will speedily follow.

Underdrainage prevents water running over the surface, and causes all surplus rain to find its way to the drains through the soil, thus adding fertility to it; whereas, were the water to flow over the surface, an immense amount of fertilising matter would be carried away—much more than is generally supposed. Thus on drained land heavy rain is a blessing instead of a curse. By drainage the soil is kept warmer and drier, and the best conditions for plant growth are obtained. It also helps in no small degree to resist the effect of the dry seasons that we are liable to, for it puts the soil in that loose, mellow condition that enables it to hold more water without at any time having too much; and further, the healthful condition of a well-drained farm will be much greater than where it is otherwise. Consequently drainage confers an inestimable boon upon the residents of the farm, as well as upon the trees on the land. There are many, very many, reasons that could be given in favour of drainage did space allow; but this I will say, in concluding under this heading, that I firmly believe that everyone who cultivates the soil can double the producing power of his land by it, not only in quantity but also in quality; and, as to quality, it will, I am sure, be freely admitted that there is ample room for its improvement, for as far as my experience goes we do not at the present time produce sufficient really first-class fruit for our own market. Until we turn the thousands of tons of second and third-class fruit that annually crowds our markets into a first-class article it will be useless for us to think of exporting to any great extent; and I say confidently that this change will never be effected while drainage is neglected.

How we should Drain.

In dealing with this part of the subject there will be several points to consider—the nature of the soil, the kind and size of drains, the quantity of water that it will be necessary to carry off in a certain time, distance apart of drains, best mode of laying them, &c., &c.

Where the soil is of a clay nature I would not advise sinking the drains to a greater depth than 2 feet 6 inches. Below that depth it will be found as a rule that the clay becomes very compact and impervious to water, so that were the drain laid deeper it would not be fully effectual, and I do not think in this sort of soil that they should be more than 20 feet apart. In soils of a more friable and open nature it may be necessary to put the drains much deeper, but then not so many of them will be required.

As to the kind of drain to be used, I think it will be admitted by all who have any experience in this work that there is nothing to beat the well-burnt earthen pipe, or, as it is commonly called, the tile drain. Of course where stone can be obtained readily and cheaply, and economy a necessity, good useful drains may be constructed by breaking the stone to about a 4-inch gauge and putting 9 or 10 inches in the bottom; but it must be remembered that with such drains there is always a liability to silt up and become inoperative, when all the work will have to be done over again; whereas with well-made and well-burnt pipe drains there is no limit to their duration.

It is most important that the drains should have a sufficient capacity to carry off the surplus water in as short a time as possible, and to this end careful calculations will have to be made. It has not been an uncommon practice in determining the size of drains to calculate for the average annual rainfall, but a moment's thought will show that this plan would only answer in a country with a very even rainfall. But here, where at times we are subject to lengthy periods of drought, and at others to phenomenal falls of rain, it will be necessary to make provision for the latter, so that as short a time as possible may elapse between the fall of the rain and the surplus being cleared off the land. This is one of the points that requires good attention, for it does not take stagnant water long to do a great deal of mischief. Formerly, and still, to some extent, very small pipes were used for laterals, but the tendency of late years has been, and I think wisely, to increase their size. I would not advise anyone to lay down anything less than a 2-inch lateral, and of course the size of main drains will have to be regulated by the number of laterals connecting with them, which in turn will be determined by the area to be operated upon. By all means have the drains too large rather than too small.

How the drains should be laid: This part of the business requires the greatest care, for upon the pipes being well and truly laid depends the success or failure of the whole scheme. The ground to be drained should, in the first instance, be carefully surveyed, the lowest points ascertained, and the lines for the main drains marked off, after which it is an easy matter to range out the lines for the laterals. Then if it is possible to use a plough the top foot of the excavation may be opened by this means, not much labour being required to throw the loose earth slightly to one side, after which the remaining depth must be removed by manual labour, using spades suitable to the work; and it is in digging this lower portion that great care is necessary so as to get an even grade in the bottom, otherwise a good deal of extra labour will have to be expended in obtaining it. A true grade for the pipes to lie on is of the first importance. Should there be any hollows

in which water would lie you may be sure the tree roots will find them out. The roots will enter the drain joints, continue to grow, and eventually choke it. This is a point that too much stress cannot be laid upon. With regard to the actual work connected with draining I would advise anyone in the first instance to procure a complete set of suitable tools. These will not be found to run into much money. By doing this the work will be much expedited and labour economised. When the pipes are laid about 6 inches of clay should be laid over them. This should be firmly and carefully trodden down, after which the remainder may be filled in by any sort of labour. Possibly using the plough will be found the most expeditious plan of turning the soil back.

Every area to be drained will have its own peculiarities, and it is only by a complete and detailed study of each individual case that anyone will be able to arrive at what is the best and most economical course to be pursued; and I would strongly advise anyone who contemplates draining to any extent, if he has not had any previous experience, to consult some one qualified to advise on the subject. By so doing a good deal will be saved both in vexation and cost. The work will be reliable, and a little outlay in this respect will be found a great gain in the end. I would say to any intending orchardist, by all means in the first place drain your land, for by this the great cost often incurred in trenching may be saved. Of course, if one can afford to drain and trench as well, possibly so much the better, but I am of opinion that land broken up with a heavy plough to a depth of 14 inches, and thoroughly under-drained, is sufficient for all purposes. The drains will cause the bottom soil to disintegrate sufficiently for the roots to penetrate; and I would point out that trenched land without under-drainage is really a great deal worse than were it not trenched at all, for it only aggravates the evil by being in a condition to hold an immense quantity more water that has no possible chance of getting away.

As to when we should drain, I would recommend starting the work, if possible, early in the autumn, after the first rains have fallen, making the ground sufficiently soft to allow of easy and economical working, rather than leave it later in the year, when the ground becomes saturated and sloppy to work; and it will be found when growing plantations are to be operated upon, if done early in the year, that a very marked difference will take place in the next season's results. In many cases it will be found that the extra yields, both in quantity and quality, will be sufficient to pay for the whole cost of the drainage.

Finally, I would say, and say it advisedly, that thorough drainage is the beginning and end of all successful cultivation. It is the keystone of the whole structure. Without it you may cultivate, manure, spray—in fact, do everything on the surface in the most perfect manner possible, but without thorough drainage you will never reap a full and adequate return for your labour and expenditure.

On the Choice and Use of Artificial Manures.

By F. B. GUTHRIE,
Departmental Chemist.

Crop Requirements—*continued.*

Leguminous Crops.

Comprising such crops as the pea, bean, lupin, lucerne, clover, vetches, &c., stand midway between the cereals and root-crops with regard to the amount of fertilising materials they contain. The following numbers show the composition of beans and of red clover.

Beans.—A crop of 30 bushels grain consists of 2,000 lb. grain and 2,200 lb. straw, and contains 99 lb. nitrogen, 67 lb. potash, and 29 lb. phosphoric acid.

A *Red Clover* crop of 2 tons contains 102 lb. nitrogen, 83½ lb. potash, and 25 lb. phosphoric acid.

In addition to the above, leguminous crops contain a large proportion of lime, amounting in the clover crop to 90 lb. None of the cereals contain more than 10 lb. lime in the entire crop. Potatoes contain about 27; mangels, 43; and turnips, 70; so that it will be seen that the proportion of lime in the leguminous crops is considerable. They thrive best on calcareous soils, and derive special benefit from the addition of lime as a manure. But the most striking peculiarity about this class of plants lies in the fact that they can be practically independent of the soil for their supply of nitrogen. It has long been a vexed question, and is still undecided, whether plants are able to utilise the nitrogen of the air by means of their leaves. There is no satisfactory evidence hitherto of this fixation of nitrogen by the leaves of growing plants, and it is quite certain that the amount thus obtained is inconsiderable, and not sufficient to enable them to thrive independently of the soil-nitrogen. The case of leguminous plants is, however, quite different, and exceedingly interesting. It appears from experiments of Hellriegel and Willfarth, and, later, of Lawes and Gilbert, on peas, lupins, vetches, and lucerne, that there exist in the root-nodules, or small excrescences on the roots of these plants, certain minute organisms which are capable of assimilating free nitrogen and of rendering it in an available form to the plant. These organisms act, therefore, as carriers of nitrogen between the air and the plant, and the root-tubercles become a storehouse from which the leguminous crop derives its nitrogenous food. The air from which the nitrogen is thus withdrawn is the air in the interstices of the soil, and as this is continually renewed, especially in the case of a porous soil, from the outside air, the supply of nitrogen is practically an inexhaustible one. The form and appearance of these nodules vary somewhat in the different plants, being generally large or small swellings on the root or root-fibres, sometimes single and sometimes agglomerated. It is generally believed that the soil-nitrogen is drawn upon in the first place, and that it is supplemented by the

nitrogen obtained from the air by the above method of fixation. Though leguminous plants exhibit this peculiarity in a special degree, there is reason to believe that other plants are able to fix nitrogen from the air in a similar manner, though in a much smaller degree.

On account of this property possessed by leguminous plants, such plants derive little or no benefit from the application of nitrogenous manures,—in fact, it has been observed that the formation of root-tubercles is reduced, or even stopped entirely, by the addition of much nitrate.

The manures that particularly benefit leguminous crops are such as contain potash. Taking further into account the proportion of lime necessary, the following would be found a useful average formula. A dressing of lime in the autumn, say 1 ton to 1½ tons per acre, followed by a top-dressing to the crop of 3 cwt. superphosphate and 2 cwt. kainit per acre.

Green Manuring.

Not only do the above-mentioned class of crops require no added nitrogen, but they actually enrich the soil in this ingredient. The land on which such a crop has been grown contains a larger proportion of nitrogen than before. This property is turned into account in rotating crops. When clover is grown between two crops of wheat, the second wheat crop derives the benefit of the nitrogen accumulated by the clover. It also suggests a means of supplying nitrogen to the soil without the addition of nitrogenous manures. If a leguminous crop is grown, and is ploughed into the land just before it reaches maturity, a manure is thereby added to the land containing about 100 lb. of nitrogen to the acre, that is to say, the land has received a manuring of nitrogen equivalent to that produced by the addition of 4 cwt. sulphate of ammonia or of 8 cwt. of dried blood per acre. Of course, with such treatment, the land is occupied for a certain length of time (dependent upon the rapidity of growth of the crop), and the crop so grown may be utilised to better advantage. The crops suitable for green manuring are, therefore, those that mature most rapidly, and occupy the ground for the shortest time, and which are otherwise of no great value. Perhaps such crops as the cow-pea, or vetches, or clover generally meet these requirements, but the choice will depend upon the surroundings of the individual. The crop may be fed as pasture to cattle, in which case a small proportion of fertilising matter is lost, which is nearly compensated for by the use of the crop as fodder. Another advantage of green manuring lies in the fact that by the decay of the crop thus ploughed in a supply of humus is produced, and the vegetable acids and carbonic acid produced by the decay of the plant assist in the decomposition of the soil and the liberation of available plant-food. They also bring up considerable quantities of plant-food from the subsoil. Clay soils are specially benefited mechanically from the ploughing in of such crops.

Fruit-trees.

Of the manuring required for orchard-trees and its application, I do not propose to discuss, as the matter has been carefully treated in these pages, in the December, 1893, number of the *Gazette*, by Mr. Benson. All fruits contain considerable proportions of potash and phosphoric acid, and of nitrogenous matter ; moreover, the assimilation of nitrogen promotes the formation of sugar in the fruit, so that it may be generally said that a good general manuring, containing lime, potash, phosphoric acid, and nitrogen, is essential for the production of fruit in highest excellence, in addition to the

mechanical treatment of the soil by effective draining, &c. Analyses of th ash of the different fruits grown in New South Wales are being conducted i the laboratory of the Department, and when these are completed we sha possess more accurate data on which to base the necessary calculations fo the formulæ of manures than we possess at present, being dependent upo analyses of European and American varieties, which differ so largely among themselves as to render it more than probable that our own fruits differ i composition from them, grown as they are under different conditions of so and climate, and that they will require correspondingly different treatmen

In the above notes we have attempted to realise the principles on whic the successful application of manures depends. We have found that differe crops not only require special foods, but that they require such food in form which varies in different cases, and that in deciding upon the manur to be used in any particular instance it is of first importance to know th form in which the food required by the crop is most readily availed of by th crop. Second in order of importance are the composition of the crop and o the soil.

In the next number the source and composition of the principal simpl manures will be discussed.

Here follow a few rules with regard to the precautions to be taken in th use of artificial manures:—

1. When purchasing a manure always insist on a guarantee of its com position as determined by analysis.
2. It is as a rule better to purchase simple manures, and to mix the yourself in the proportions requisite for the particular case rath than to buy complete fertilisers ready mixed. In the first plac the simple products are much less liable to adulteration, and th adulteration is much more readily detected; in the second plac you will avoid purchasing and paying for an excessive quantity o an ingredient which may not be required in the particular case fo which you are using it; and in the third place, you save the cost o mixing. As these artificials are seldom required in greater quanti ties than can be easily mixed by hand, the trouble involved is ver small. The simple manures are:—Bonedust and superphosphate containing phosphoric acid and nitrogen; dried blood and sulphat of ammonia, containing principally nitrogen; kainit, sulphate o potash, and wood ashes, containing potash; lime, gypsum, &c containing lime.
3. Soluble manures are best applied when the plant is above ground.
4. All artificial manures should be mixed with about three times thei weight of dry loam, and distributed evenly.
5. Soluble manures should be used with caution on very porous soils.
6. Soluble manures are applied superficially; and the insoluble manure can be harrowed in lightly.
7. They should be used in conjunction with farmyard manure as a rul
8. Never add lime to a manure containing nitrogen; and when lime ha been applied to the land do not use such manures until about thre weeks afterwards.
9. The depth of applying the insoluble manures will be regulated t some extent by the length of root of the crop, but as a rule it i not advisable to manure to too great a depth.

Chemical Notes.

A few simple Hints for detecting Adulteration in Artificial Manures.

It must be premised that it is of no use attempting the roughest analysis of a manure without a fairly accurate balance. The substances likely to be added as adulterants, or whose presence in quantities lower the value of the manure, are not foreign matters, but those like sand which already exist in the manure; therefore, all attempts to decide the value of a manure must depend upon an estimation of the quantities of the ingredients present, and these cannot be estimated without a balance which must be capable of weighing half a grain.

In the absence of such an instrument the following rough tests may be found useful in giving an approximate idea of the purity of a few of the simple fertilisers:—

Bone-dust.—A good sample of bone-dust, however fine, shows the bony structure in some of the larger pieces. It should be as dry as possible, and in a fairly fine state of division. It should have the characteristic smell, though there is no need that the smell should be offensive. It does not follow that a bone-meal is necessarily good because the smell is disgusting—indeed, some of the best samples of bone-meal received at the Department for analysis have been nearly free from smell.

Take about 100 grains in a small iron spoon or ladle; heat it strongly in a brisk fire. The heat should be applied cautiously at first to avoid loss by spurting, after which it may be heated as strongly as possible. Any moisture present, all the organic matter, and carbonic acid are driven off by this means, and the "ash" left behind contains phosphate and oxide of lime, and magnesia, with a small quantity of alkalies. This ash should be quite white if the bone-dust is pure, although it may require some patience and a pretty hot fire to get it white. This ash is now allowed to cool, and emptied into a glass beaker or a basin which will stand heat. If such a vessel is not at hand, a small enamelled saucepan may be pressed into the service. Pour into the ash in this vessel about half-pint water and a few ounces of hydrochloric acid, and boil well for about five minutes. The substance should dissolve completely in the acid, or leave only a very small residue. If there is any considerable residue left undissolved, the presumption is that sand has been mixed either purposely or accidentally. Allow this acid liquid to cool; pour it off from the sand into a tumbler or glass jar. A rough indication of the quantity of phosphate of lime present may be gained as follows:—Add dilute solution of ammonia until the liquid smells of ammonia. This will form a dense white precipitate of phosphate of lime, and a little practice will enable you to judge from the bulk of the precipitate after it has stood for two hours of the relative proportion of this ingredient in the manure. If the same quantity (100 grains) be taken in each case, you will know what

quantity to expect from a good sample. If no precipitate, or only a slight on is formed, the manure may be discarded. I know of no method by which eve an approximation of the nitrogen can be made without apparatus. As sand i the most likely adulterant, it will generally be sufficient to test for it a above. This method will detect sand in bone-dust, dried blood, and suc products.

Sulphate of Ammonia should be a whitish crystalline powder, fairly dr and friable. It should dissolve completely in water without leaving an residue, and on placing some in the iron spoon used in the test for bon dust, and heating it strongly in the fire, it should completely volatilis leaving no ash. A fair idea of its purity may be inferred from the quantit of the residue thus left. A perfectly pure sample would volatilise com pletely, leaving the spoon perfectly clean. If a little of the powder b mixed with slaked lime, and heated in the spoon, a strong smell of ammon will be given off. If there is none, the substance is not sulphate of ammon at all, nor any ammonium compound. Dissolve a little of the salt in wate and add a few drops of ferric chloride, which can be prepared by dissolvi a little iron rust, scraped off a rusty iron implement, in hydrochloric aci If a deep blood-red colour is produced by this reagent, the manure shou not be used, as it contains a compound which is injurious to plants, namel sulphocyanide of ammonium. The solution of sulphate of ammonia shou not alter the colour of blue litmus paper; if it turns red, the salt contai free acid and should not be used.

Kainit should be a crystalline powder, resembling common salt, more or le white, often of a reddish or darkish tinge, generally damp to the touch. should almost entirely dissolve in water, and should be completely soluble water to which a little hydrochloric acid has been added. The potash cann be estimated by any simple method with any degree of accuracy.

The above tests require no other reagent than a little hydrochloric ac and ammonia, and though they are not, in any sense of the word, accura analyses, still they may prove useful when there is any doubt about t purity of any of the substances in question.

With the help of a balance which will indicate half-grain, such as a druggist possesses, the following scheme will enable a fairly close estimati being made of bone-dust.

The following articles and chemicals will be required:—A balance (turni to ½ grain), pure hydrochloric acid, pure ammonia, a packet of cut filt papers, glass beaker, pestle and mortar, a sieve of eighty meshes to the line inch, porcelain basin, a glass funnel, some strips of litmus paper. These ca all be obtained at the local druggists.

It is very important to obtain an average sample of the bone-dust. To this, if the sample is contained in one bag, empty it out upon a clean boa or floor and mix it well with the shovel. If in two or more bags, take sample from the middle of each bag and mix them as above. From th mixture take about a spadefull and grind it thoroughly in the mortar un the whole of it has passed through the sieve. The sifted sample is aga mixed and is ready for analysis.

A piece of glazed writing paper is placed on one of the pans of the balanc and exactly counterpoised by placing a similar piece of paper in the oth pan. Weigh out exactly 200 grains of the finely-powdered manure upon th paper, introduce it without loss into the iron spoon, heat very gently at fir and then gradually more strongly until the ash is white. Care must be tak not to lose any by spurting. Allow to cool, empty back again upon the pap

without loss and weigh. The weight now should not much exceed 80 grains. This is now emptied again into the porcelain basin, about half-pint water added, and about three ounces strong hydrochloric acid. Boil well for about five minutes, add a little more water, and filter. Filtering is done as follows: Fold one of the round papers in half, now fold again in half at right angles to the first fold. On opening this out it will be found to fit exactly into the funnel. The funnel with the filter-paper is now supported over a beaker placed below it. The liquid in the dish is now poured through the filter, rinsing it out with water so as to get all the sand on the paper. The paper with the sand is now placed in the oven until quite dry, and weighed. If a second filter-paper be placed in the other scale, the weight required will represent the weight of sand. This should not be more than 3 or 4 grains. This number divided by two will give the percentage of sand and insoluble matter in the bone-dust.

The filtered liquid is now neutralised with ammonia—that is to say, ammonia is added till the solution turns red litmus paper blue. Allow this precipitate to settle and filter again in the same way as the sand; dry and weigh as before. The weight of this precipitate divided by two gives the percentage of phosphate of lime in the bone-dust. This should not be less than 40 per cent.—that is, the precipitate should weigh at least 80 grains. The above scheme does not pretend to scientific accuracy, but it will give a fair approximation to the actual composition.

As the efficiency of a bone-dust depends much upon the fineness of division, it is as well to grade it roughly by passing it through a sieve with twenty-four meshes to the linear inch. Three-quarters of the weight of the manure (75 per cent.) should pass through the sieve.

It must be thoroughly understood that the above tests are only intended as a rough guide as to the purity of a manure. If the quantity of impurity is found to be excessive, a sample should be forwarded to a qualified analyst for his report.

Analysis of Bone-dust.

The following is an example of a good quality of bone-dust offered by the Soap and Candle Company, Kent-street:—

Moisture	= 7·72	
Organic matter	= 36·75	(containing nitrogen = 4·06)
Sand and insoluble matter ...	= 1·12	
Tri-calcium phosphate ...	= 49·61	(phosphoric acid = 22·71)
Other lime salts, calculated as carbonate ...	= 4·37	

Mechanical condition.

Fine	= 42·5 per cent.
Medium	= 53·0 „
Coarse	= 4·5 „

This is in every respect an excellent sample of bone-dust. The value of the fertilising ingredients is £6 5s. per ton. It is offered at £4 10s. per ton, and at that price should prove an economical fertiliser.

An analysis of a sample of this firm's bone-dust was made last year, and published in the *Gazette*, from which it will be seen that they have succeeded in considerably improving the quality of their product.

The Spaying of Cows.

By W. J. STEWART McKAY, M.B., M.Ch., B.Sc.

In the following paper I propose to give an account of the operation spaying as performed on cows. I intend to divide the paper into four se tions. In the first I shall give a description of the yard, bail, and instr ments required. In the second section I shall give an account of t anatomy of the parts, written rather for students and those understandi the anatomy of the cow. In the third part I shall describe the steps of t actual operation, and shall finish by giving an account of the results on t cows spayed and the conclusions to be drawn from the experiments. M experience has been gained from taking part in the spaying of forty-t head of cattle. These were generously supplied by Mr. S. Burdekin, a Mr. Lamrock of the Kurrajong, who has had considerable experience spaying, was good enough to give us demonstrations, after which I, wi others, did the operation on various cows. The youngest calf dealt with w about two months old, and at the other extreme were some old cows ve poor in condition. Between these classes were cows in calf, young heife and cows that had just calved; in fact, every variety that could reasonab be supposed to occur. In addition to the operations on the live stock have taken the opportunity of dissecting the parts in a freshly-killed co kindly placed at my disposal by Mr. Percy Lamb. I have, from this spe men, been able to study the position of the parts in the body, and after t removal of the uterus and ovaries I have had the vessels injected in order ascertain the blood supply to the ovaries, &c.

The Yard, &c.

The yard constructed by Mr. Burdekin for our purpose was suitable about eighty head, and was construct on the following plan:—

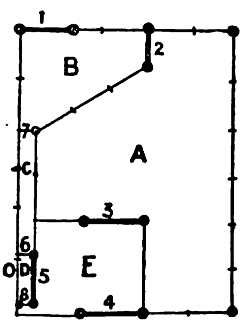


Fig. 1.

It was about 50 ft. long and 40 ft. wi A is the chief yard and leads in by gat to B, which is much smaller and triangul in shape. It is entered by gate (1) a leads by gate (7) to C, the crush, whi should be made narrow, else the cat will turn in it; and the posts in t fence on either side should have t edges smooth and not projecting too f so that the cattle will not knock the selves about too much. The crush lea into D by the gate (6). The gates and 6) should open towards the yard and when closed a stout bar of wood should be put on the side of B, so th

if a cow runs back she will not knock the gate off its hinges. The bail yard D has the fence on the left side, a gate (6) behind, and one (5) on the right side, and the bail (8) at the end.

The bail is constructed on the following plan:—

Two strong posts A and B are joined by double cross-bars C and D, while E reaches from the angle between C and B down to D, in order to strengthen the bail, and to prevent the cow rushing through between F and B. F is a movable piece fixed to the cross-pieces D at X, and sliding between the upper cross-pieces C. The distance of X from the post A is about 6 inches. To this movable piece F is fixed a rope, which passes

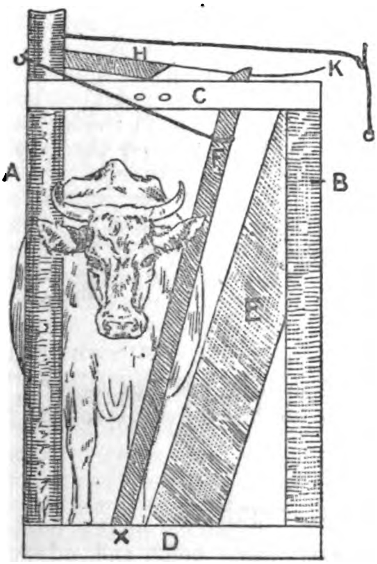


Fig. 2.

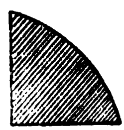


Fig. 3.

over a pulley near the top of the post A, then, passing round the post, it is carried across to the near side, and allowed to hang down by B. The top of the movable piece F is rounded off, as shown in the figures 2 and 3. When the rope is pulled F slips up towards A, and hitting against an iron frame H,* this is thrown up, and the top of F slips under it, and is caught. The iron frame H is fixed by a pivot into the post A, and it has a long handle K, which is raised when the upright F is to be let free. The bar of H that catches F should be about 9 inches from the post A, but as this may not be close enough for young cattle, it is well to have some holes in C in which the ordinary pegs can be placed.

The gate 5 (fig. 1), leading from the bail, next calls for description.

In fig. 4 is seen a double gate. The chief gate (unshaded) swings on the post A, and is so swung that it will open into the bail or out into the yard, as shown in (fig. 5). This is a very important point, inasmuch as it is by pressing the main gate inwards, so as to meet the hind quarters of the cow, that we keep her still during the spaying.

The second gate suggested itself to me after we had finished the spaying, for it was found that the bar D (fig. 4), when carried on to the upright C was so much in the way that it had to be cut out, and a temporary bar held in while the cow was being placed in the bail, the consequence being that some of the wild cattle jumped through the bars. This second gate would then be of great use while the cow was being bailed up; after she was safe it would be opened, and the operator would have plenty of room.

* H is a quadrilateral iron frame, not a solid bar, as shown in figure.

For large cattle perhaps it would be better if the cross-bar E met the lower bar at F (fig. 4). Outside the fence, on the off-side of the bail, a stout post A (fig. 5), should be fixed for the leg-rope, which is put on the

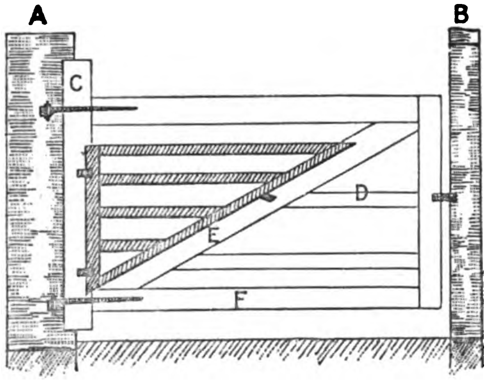


Fig. 4.

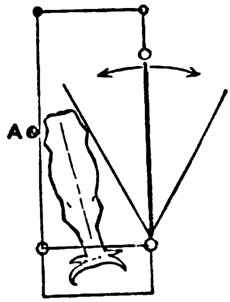


Fig. 5.

near hind leg, and carried round behind the cow, and put round A, or held there by some one. When the spaying is finished the cow is let out through yard E (fig. 1), by gate (4).

Instruments, &c., required.

A strong triangular needle, with very sharp point and edges, about 3 inches long.

A sharp knife, shaped like the ordinary castrating knives, with the curved edge.

A number of pieces of sailmaker's twine, cut into lengths of a yard or more.

Some Stockholm tar and fresh dripping. Mix about six parts of tar to one of dripping. This allows the tar to be more easily applied to the wound.

A bucket of water, towel, and soap.

The anatomy of the regions concerned in spaying.

When a cow has been kept without food for some twelve hours or more there is noticed just immediately in front of the hip a well marked triangular depression, which allows a stockman to tell whether a cow is "hollow" or not. This is the region in which the incision for spaying is made.

The triangular area is formed as follows:—The front (anterior) border is formed by the last rib, the hind (posterior) border by the projection of the hip-bone (ilium), and a distinct chord of muscle (flesh) which runs from the projecting part of the hip-bone downwards and forwards, and which is merely a fold of the abdominal (belly) muscles presently to be described.

The upper (dorsal) border is formed by the transverse processes of the lumbar vertebræ covered on top (dorsally) by the erector spinæ muscle, and underneath (ventrally) by the quadratus lumborum. These parts are quite

familiar to every one in the sirloin of beef, the uppercut being part of the erector spinæ, the bones with marrow (cut through) are the lumlar vertebræ, the rib-like bones between the upper and undercut being the transverse processes, the undercut being the quadratus lumborum furthest from the marrow end, and psoas muscle nearer the "marrow end," while the "end" makes up the area A (fig. 6) of the triangle, and is composed of the muscles now to be described, and is the part cut through in spaying.

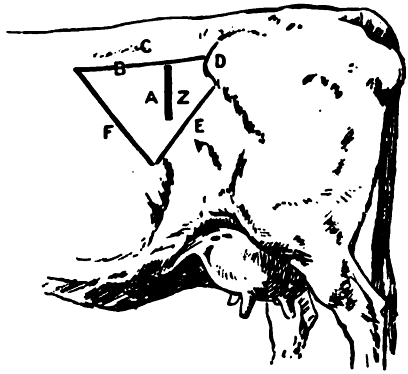


Fig. 6.—B, F, E is the triangle described above; F the last rib in front; E the fold of muscle behind; B the erector spinæ muscle and transverse processes of the lumbar vertebrae; C is the erector spinæ (the uppercut); D the hip-bone (ilium); Z is the line of the incision for spaying; A is the area described in the text as made up of the abdominal muscles.

When the skin (sk. fig. 7) has been dissected from the area A (fig. 6), we find that the first muscle met with is the panniculus; the muscle known to all as a red sheet, on which butchers are fond of cutting various figures when the sides are hung up in their shops. The muscle does not extend over the whole of A, but as far as its lower part. It adheres firmly to the skin. After this we come on a layer of fat (ft. fig. 7). Then on the first layer of muscle, called the external oblique, the direction of whose fibre is from the ribs downwards and backwards (ext. o, fig. 9). This being cut through, we come on a layer of fat and then the second layer, called the internal oblique (int. o, fig. 7) with fibres running in the opposite direction. Then another layer of fat and the third layer of muscle, called the transversalis, with the fibre very much in the same direction as the external oblique (fig. 7, tr.). Then a layer of fat and a thick layer of white tissue, called the fascia transversalis (fig. 7, x). On removing this we come on the last layer, called the peritoneum, which is easily recognised by its shining appearance and by the fact that as soon as it is torn through the air rushes into the belly with a loud gurgle.

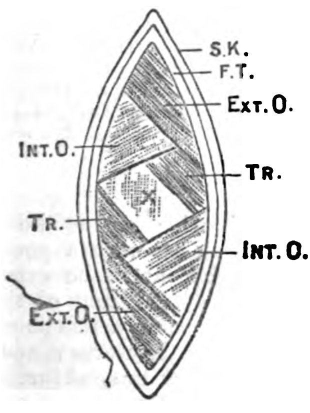


Fig. 7.

There are no arteries of any great size passed through, nor yet veins or nerves.

The best idea that can be obtained of the position of the organs of generation in the cow will be to view the parts in a slaughter-house, when a cow has been killed and hung up by the hind legs.

When viewed in this position we see the parts as shown in fig. 8, which was sketched from a cow thus suspended.

Coming from the tail-end forward, we first encounter the bladder B which is seen as a ball (if empty) about the size of an orange. Behind and

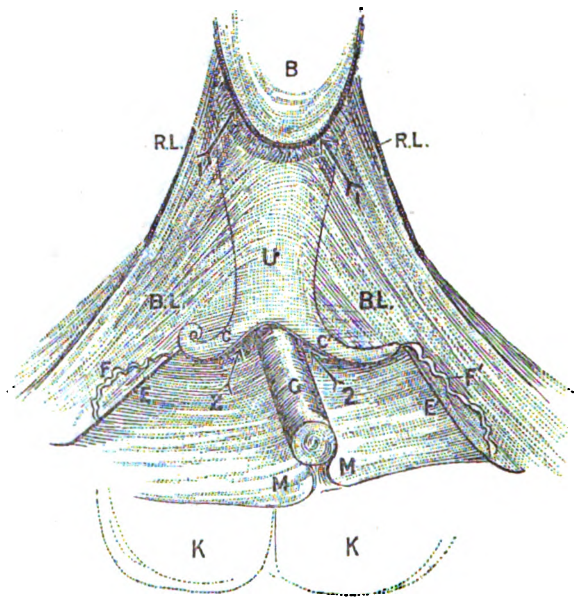


Fig. 8.—Position of the organs of generation in the cow when the animal is hung up by hind legs; B, bladder; RL, round ligament in fold of peritoneum running down to bladder; U, the body of the uterus (bearing bag); the arrows (1 1) point to the pouch between B the bladder and U the uterus; BL, the peritoneum at this position called broad ligament, it is in two folds, and the uterus and tubes are placed between the folds; the broad ligaments run to the sides of the animal and so keep the uterus and other parts in position; cc¹, the cornua or horns of the uterus; C, has the natural twist; E, is the sharp edge of the peritoneum; F¹F, the fallopian tubes leading from the horns of the uterus to the ovary which cannot be seen but is situated at about F; G, is the gut hung from the back by the fold of peritoneum M.M.; K, kidney. The arrow (2 2) point to pouch between uterus and gut.

below this hangs the uterus U or womb or bearing bag as the butchers generally call it. If we raise the bladder we shall see that a pouch exists between the bladder and uterus, and that the hand cannot be extended far behind the bladder, because the peritoneun runs off the front of the uterus on to the back of the bladder. The arrows (1 1) point to this pouch. The bearing bag is divided into two portions, the body of the uterus U, and the two horns or cornua (c c) which run out from the body at the end furthest away from the bladder. These horns are twisted as shown in figure at C, but they can be easily straightened out as shown at C¹, when it is seen that they be-become narrower as they run out from the uterus. The next point that must engage our attention in the peritoneum. It is by means of this membrane that the uterus and ovaries (stones) are held in position. If we look at (fig. 8) we shall see that the membrane runs over the uterus and extends out in either side as BL (called the broad ligament). We have seen that near the

bladder it forms a pouch by running off the front surface of uterus on to the back surface of the bladder. If now we follow it forward it runs over the uterus and the horns CC, then round the horns to get to the back of the uterus, where we shall follow it presently. Where it turns back at the side of the horns we have a sharp edge formed EE, which is a valuable guide in spaying. If the sharp edge EE be examined now, we shall see just close to it a twisted tube F F[1] running in the peritoneum. This is the fallopian tube which conveys the egg from the ovary to the horn of the uterus. We cannot see the ovary unless the edge E is lifted up because the ovary lies on the other side of the peritoneum. If we introduce the hand between the uterus (U) and gut (G) we shall find that another pouch is formed on account of the peritoneum running off the back of the uterus in to the gut (G), this is called the pouch of Douglas.

To examine the position of the ovaries we must now remove the uterus and broad ligaments (BL), and lay them out, as shown in Fig. 9.

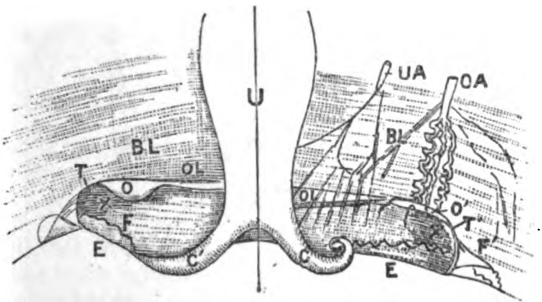


Fig. 9.—The uterus and broad ligaments have been cut out of the cow and turned over to show the ovaries. These parts are now in the position occupied by them in the animal :—U, the uterus; C, C[1], horns; E, sharp edge of the peritoneum; BL, broad ligaments; O, the ovary; O[1], the ovary has been cut away; OA, the ovarian artery entering the ovary at the points O[1]; UA, the uterine artery joined by a branch from the ovarian; OL, chord of muscle which enters the ovary, and is called the ovarian ligament; F, the fallopian tube; F[1] the trumpet-like end joined to the ovary at T; X, marks a pouch or depression in the peritoneum, called the "ovarian pouch," in which the ovary lies.

The ovary is seen (in Fig. 9) in the position which it occupies at the time we are spaying; that is, it lies on that surface of the broad ligament which is nearest to the backbone. It is an oval-shaped body, which varies in size with the age of the cow. In calves it is about the size of a green pea; in two-year heifers it is about the size of a broad bean; while in old cows it may be the size of a bantam egg or longer. It is attached to the broad ligament by one edge (Hilum), and when cut away from here a narrow oval surface is left in which the mouths of the ovarian arteries are seen as shown in (Fig. 9) O[1]. Being attached to the broad ligament by one side only, it drops forward into a depression immediately in front of it, and shown in the figure by the dark shading (X). It is attached by one end to the uterus by a chord of tissue (OL), and this must be cut through in spaying. Its other end has a portion of the trumpet end of the fallopian tube fixed to it at (T).

It will be noticed that the branches of the ovarian artery are very twisted, and that the uterine artery gives no branch to the ovary. The peritoneum

after turning back runs till it gets near the bladder (B) and turns forward over it, forming a second pouch, shown above in Fig. 8 (arrow 1), and ir Fig. 10. The ovary O is seen resting on the upper part of the broad ligament close to the sharp edge E (Fig. 10).

We now see how to find the ovary, for if the hand is introduced from th near side, and carried up to the back the gut (G, Fig. 10,) hanging down wil soon be found. If this is followed back the hand runs into the pouch (X) an therefore will rest above the uterus (U). This found, we carry the han forward until we come to the horns on either side (C) One of these followe out will lead us to its curled end, and we shall then find the sharp edge (E) Raising our hand it will rest on the broad ligament (BL), and we shall easil find the ovary O.

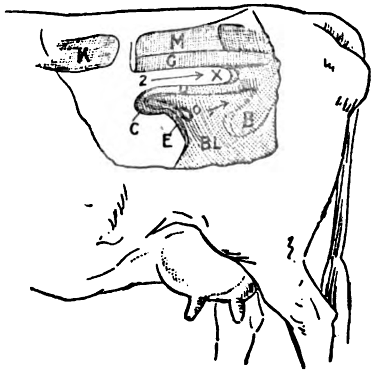


Fig. 10.—Compare this figure with figs. 8 and 9. A portion of the near side is supposed to be removed, and the parts are seen in the position in which they are when we are spaying. Near the back bone is seen, in front, the kidney K (figs. 8 and 10); behind this the gut (G) hangs from the back by (M), a fold or peritoneum (figs. 8 and 10); the peritoneum turns off G on to the top of the uterus (U); the arrow is pointing into the pouch thus formed and called the pouch of Douglas; the peritoneum runs forward in (U) and out on either side, as shown at B L; having reached the front of (C), it turns under the uterus, and at the side, the place where it turns back is marked by the sharp edge E.

We have now examined the parts from above and below, but to get a idea of the position of the parts in the body we must suppose that we ar looking at the parts in the cow, after having cut away portion of the bell wall. Were we look in from the near side of the cow we should see th parts as shown in the diagram Fig. 10.

The Operation of Spaying.

1. The cow is placed in the bail (fig. 2), not in the position adopted fo milking, but with the near side facing us.

2. The gate (fig. 4) is opened, and the leg rope put on the near hind leg and carried round behind both legs to the off side, and fastened to the post (fig. 5), or held by a man there.

3. The gate (fig. 4) is pushed well against the hind quarters of the co (fig. 5) and the small gate (fig. 4) is opened.

4. The spot for the skin incision is chosen. Measure to a point 4½ to 5 inches in front of the hip bone (D), along the well-marked ridge B. Place the left hand on the skin just near this point so as to steady it, then cut from the ridge B downwards in a straight line from 4 to 5 inches (line A, fig. 11.)

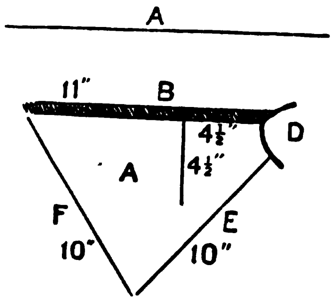


Fig. 11.—D is the hip-bone; A¹ is the mid-line of the back; B is the thick ridge forming the upper side of the triangle F B E: B is about 11 inches long on a full-grown cow; F and E each about 10 inches.

5. Having cut through the skin (during which time the cow will plunge about, and care must be taken that the operator does not get his arm jammed against the gate), we then cut through the layer of fat next met with, and we then come on the first layer of muscle (fig. 7, ext. o).

6. Cut a small nick in the first layer of muscle (flesh) about an inch long, and after that the knife is handed to the man holding the gate.

7. Push both forefingers into the cut in the muscle and tear the muscle for four inches or more up and down in the same direction as the cut in the skin.

8. Then push the fingers through the next layers of muscle and tear them in the same way.

9. A white dense layer of tissue is then met with (the *fascia transversalis*, fig. 7 x), this is torn through with some difficulty, and then we come on some fat, and lastly a thin shining membrane (the peritoneum) which is easily torn through. Care must be taken that we go through this last membrane, or we shall strip it off the belly wall and get our hand in between the dense membranes mentioned above and the peritoneum. The sensation when the hand is in this position is though our fingers were entangled in fine threads; this happened several times during our spaying.

10. On tearing through the last layer (peritoneum) we hear a gurgle caused by the air rushing into the belly cavity. The operator now faces the hind quarters of the cow and introduces his left arm into the abdomen (belly). The first thing that may be encountered is the paunch; but this seldom happens if the cow has had no food, or if not in calf.

11. The operator runs his hand not straight in front of him, but somewhat towards the tail and up towards the backbone.

12. Here we will find the bowel (fig. 10 G) hanging down from the middle line of the roof of the back, and following this towards the tail end his hand will get into a pouch (see fig. 10 x). Lowering the hand it will now be found to rest on the body of the breeding bag (uterus, fig. 10 U, fig. 9 U). Carrying the hand forward, the bag will be found to branch out into two

horns. Follow the left horn (fig. 10 c, fig. 9 c) which runs towards the operator and which may also hang somewhat downwards. At the end of the horn a twist will be found in it, and immediately we come on the sharp border (fig. 10 E, fig. 9 E) of the broad ligament. Now raise the hand above this sharp border and feel about for a small, hard, smooth body about the size of a cherry or a broad bean.

13. Seize this hard object (the ovary or stone) between the thumb and forefinger, and holding it firmly (for it will easily slip), withdraw the arm slowly, carrying the ovary and the parts that hold it, to the hole in the belly wall.

14. When the ovary has been pulled through the incision and brought to the light, the parts will have the position as shown in fig. 12.

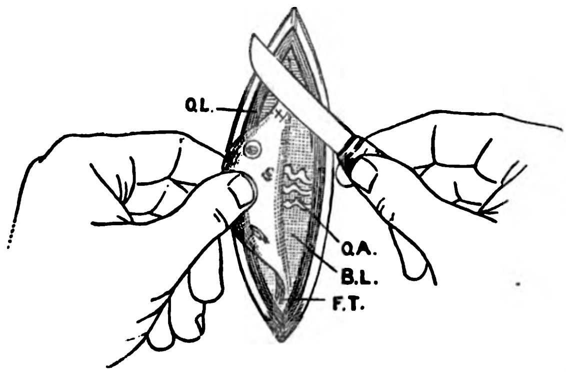


Fig. 12.—O is the ovary, OL the ovarian ligament, easily seen as a thick chord (see also fig. 9, OL); OA, ovarian artery entering ovary; BL, the broad ligament to which the ovary is attached by one side; FT, end of fallopian tube attached to ovary.

15. Now, take a knife and cut through the chord, at the upper part of the ovary, OL, and which is easily seen entering the ovary. Having cut this ligament through, the knife can be carried down close to the ovary, cutting away the broad ligament, which holds the ovary, and cutting through the ovarian artery OA, and, lastly, the end of the fallopian tube FT. It will be found better, however, to cut through the ovarian ligament OL, and then tear the ovary off. This can be easily done, and the sudden breaking of the tissues causes less bleeding than cutting with a sharp knife. (When the ovary has been removed, the edge left will appear as shown in fig. 9, o^1.)

16. Having removed the ovary, the parts will now slip back; and the hand being again introduced, the upper surface of the breeding bag is found, and the left horn is followed out and the left ovary found and pulled over in the same way. The ovarian ligament will generally be found at the lower part of the wound instead of at the upper part, because the ovary is turned upside down as it is pulled across to the opening. The ovary is now removed.

When the cow is heavily in calf.—The breeding bag will then be far forward and the ovaries are carried for some distance with it, and the paunch may be pushed far back, so that on the hand entering the belly cavity we must first carry it along the near side towards the hip so as to get round the end of the paunch, which can then be pushed out of the way. No directions for finding the ovary could be given, it is merely a matter of hunting for it.

In the case of young calves, the animal can be thrown on the ground and held while the incision is being made, then lifted on to its legs and the hand or two fingers introduced and the ovaries found. As the parts dealt with are very small the ovaries will often be found hanging almost together from either side of the uterus. These may be removed by catching each ovary between the thumb and fore-finger and cutting through the broad ligament with the thumb-nail without withdrawing the hand.

Closing the Incision.—After the ovaries have been removed the edges of the skin round the wound are drawn together with four or five stitches. The needle is pushed through the hide only, not through the muscles. When all the stitches have been introduced, the hide cut is smeared with the tar and grease.

The cow is now liberated, and goes through yard E, and out of gate 4 (fig. 1).

The after-care of the Cattle.

The cattle should be put into a paddock where they will not be disturbed. The grass should be green and have a spring in it. They may have water; and after a few days a little green lucerne to purge them. The stitches should be looked to, and if they give way the cow should be put in the bail and fresh stitches put in. If the flies get at the wound they often leave maggots, which must be scraped out and fresh tar applied. If an abscess forms around any of the stitches remove the stitch so that the matter can drain away.

Remarks on the Results obtained after Spaying forty-two Head of Cattle.

In the spaying of these forty-two head of cattle five operators took part, three of these having no experience in the operation and two being experienced hands, who did the majority of the cattle. The cattle were all ages—from two months to ten years. Of the whole number three died; of these, two were old cows in bad condition, one being in calf, and the third was a young heifer. This heifer was very wild, and had to be pulled into the bail with a rope. The first cow died on the ninth day after the operation, the next on the tenth day, and the next about the fourteenth day. Of the cows spayed, about fifteen were in calf and five slipped their calves, and of the calves four died.

I inspected the cattle thirteen days after the spaying, and found that the young cattle looked well, and that the stitches had given way in a very few cases. The old cows did not look so well, and many were evidently suffering from peritonitis judging by the manner in which they were distended with gas.

I went over the stitches on the twenty-first day, and found that in about half a dozen of the cattle the stitches had cut through, and that the wounds had suppurated. Fresh tar was put on, and after a week or two all the wounds were healed up.

If any conclusions can be drawn from the small number of cows dealt with, I should say that the following rules should be followed in spaying:—

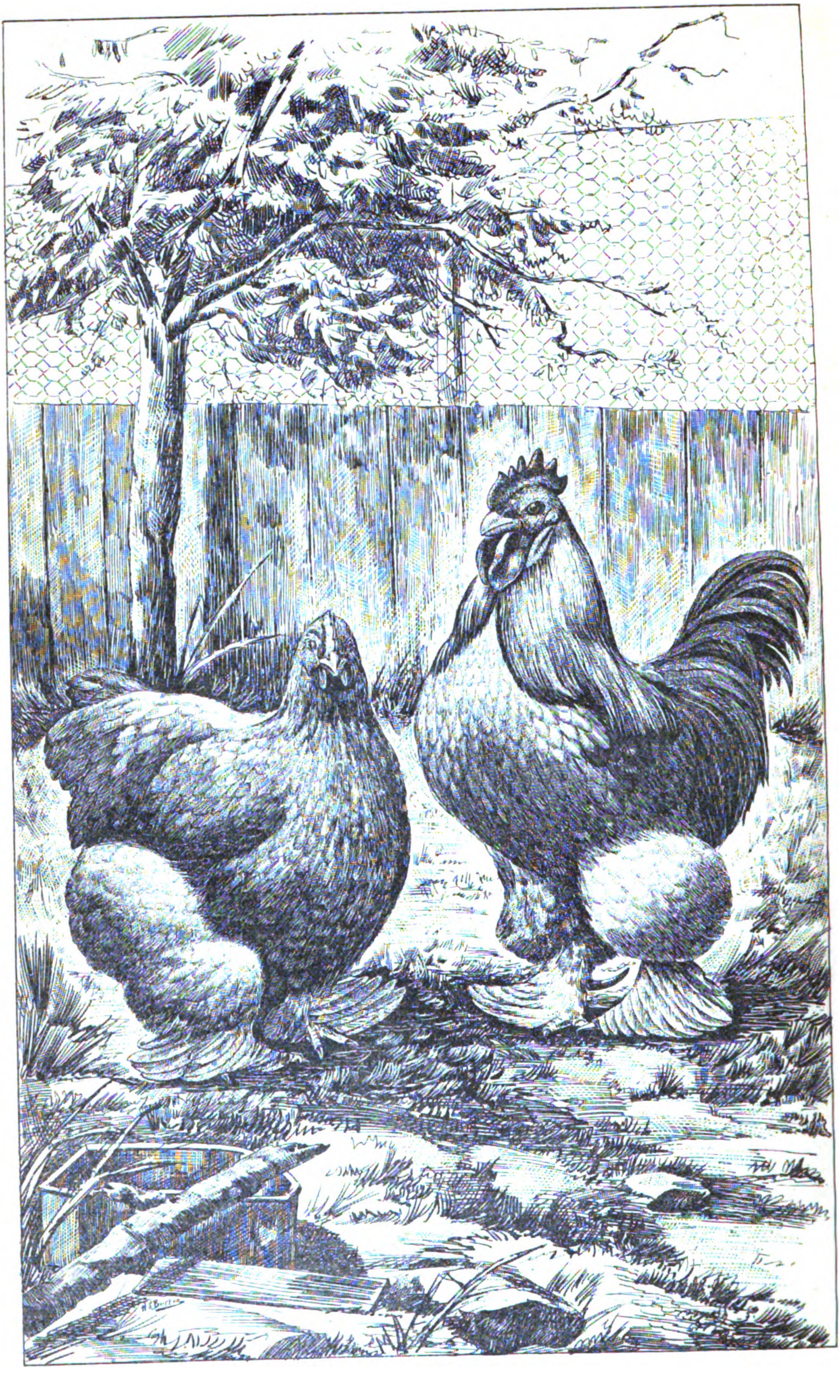
1. The time of year should be spring, before the weather gets too warm and the flies get too numerous, and also that the young grass aids the cure in providing rich fodder, and from the fact often observed that when cattle are purged they do better. There can be little

doubt that when the cattle get blown out with wind they should be purged. The wind collects in the bowels, and is, no doubt, in the majority of cases a symptom of peritonitis. I would, therefore, recommend the administration of the sulphate of magnesia in six to eight ounce doses when the animal looks "blown out."

2. The younger the animal the better chance of its getting over the operation well and quickly.
3. The cattle do not die from primary bleeding, as was shown by the fact that none died before the ninth day, and that, therefore, no ligatures are required after pulling off the ovary.
4. In many cases large pieces of the ovary are left behind, and there is no reason why the cow should not breed from these pieces. The point of this remark is that it is better to pull the ovary to the wound and see what is being done rather than pull it off by mere touch.
5. In order to prevent peritonitis the greatest care should be taken to have the hands and arms clean before introducing them into the abdominal cavity.

Concluding Remarks.

It may be asked what is to be gained from spaying cattle. It has long ago been proved that cattle that are barren get fat sooner than those that bear calves, and that if the cows are made barren artificially that they likewise become fat. Therefore, we may spay calves in order that they may become fat while still young, or we may spay cows that have had several calves in order that they may become fat, and we may thus get rid of old cows for beef, which would otherwise remain poor, and breed weedy calves. Lastly, it has been found that if a cow is spayed while in full milk that she will go on milking for months, and sometimes for years. A squatter has assured me that he has known a bullock, 5 years old, go on his knees so as to be able to suck at his mother, a cow that had been spayed four years previously. I might also point out that spaying may be used for the following case:—If one owns a well-bred cow, which, if a breeder, would bring a large sum of money, but if barren would only bring her price as far as beef was concerned, it may happen that the owner, after keeping her for some time, may be in doubt as to whether she is is calf or not. By placing her in the bail, and making the incision as in spaying, the point would be immediately cleared up. This may seem an out of the way case, but Mr. P. Lamb has informed me of a case that occurred when a very valuable cow, after being kept for some years, was sold to a butcher for beef, and when killed was found to be in calf. In conclusion, I would say that there appears to be very little pain connected with the operation, and that after the skin is cut through the cow does not appear to suffer.



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BUFF COCHINS.

Poultry.

By S. GRAY,
Sub-Editor.

The Cochin.

THERE are two points in connection with the Cochin without mention of which any description of them would be incomplete. This breed of fowl is called the "father of the poultry fancy," from the fact that on their first exhibition in 1847 they created a vast amount of public attention, and in fact the popularity of poultry shows dates from that event. Previously, it is recorded, such shows were confined to the very few breeders who took to poultry as a hobby, but on the advent of the Cochin, poultry-keeping may be said to have become general amongst people of all classes. The other point is, that the Cochin is one of the breeds the improvement of which is due to English rather than to American breeders.

The breed originated in China, and, as already stated, the first specimens showing the characteristics of those we have at the present day reached England in 1847. Since that time breeders have worked patiently on until the present-day bird has become a wonder to all observers. The feathering is unique, the feathers having a larger web and finer and weaker shaft or quill than is possessed by any other breed, these peculiarities accounting for the beautifully soft downy appearance of the birds.

According to *Lewis Wright*: "A Cochin cock ought not to weigh less than ten or eleven pounds, and very large specimens range from that weight to as high as fifteen pounds; but the latter weight is very rare, and is generally, according to our observation, accompanied by a clumsy and ungainly carriage, though we have seen some exceptions to this rule. A good Cochin looks larger even than his actual weight, as the plumage is very loose and fluffy, a peculiarity which arises from the feathers being broader across the web, and thinner or weaker in the shaft or quill than that of other varieties. The comb is single, and should be perfectly upright, free both from twist and any tendency to fall over, with a fine arched outline and neat, handsome-looking spikes; both comb, face, deaf-ears, and wattles being as fine in skin or *texture* as possible. This point is greatly valued by fanciers, a rough, warty-looking skin being much disliked. The head, which should be carried slightly forward, is rather small and very intelligent looking; the neck rather short, and very thick and full in the hackle, which should be long enough to flow well over the shoulders and back; the shoulders somewhat square and very broad across; the breast rather high relatively, but should be prominent, full, and broad. The back so short as to have hardly any length at all, but wide and flat crossways, and running off almost at once into the saddle. This last is one of the most important points in a Cochin cock; it should be nearly or quite as broad as the back, begin to rise

almost from the very base of the neck, and rise more and more gradually towards the tail, forming no angle with the feathers of that member, but a nice, harmonious, continuous line. The body to be short, but very deep, and the 'fluff' on the thighs standing out as much as possible in globular form. This and leg feather form perhaps the second great point in a good Cochin. The hocks ought to be thoroughly well covered with soft, curling feathers, but free from stiff, projecting quills (vulture-hock), and the shank feathering heavy, standing out from the shanks well. The legs should be short, and as wide apart as possible.' The tail and wings are also important, the tail of a good Cochin containing hardly any quill, but merely soft, curling feathers; and the small and short wing being well clipped up to the sides, and the points almost buried between the saddle-feathers above and the fluff below. The breed, in common with Brahmas, is peculiarly subject to what is called a 'slipped' wing, or the flight feathers protruding outside the secondaries instead of being nicely tucked under. This fault greatly diminishes both the value and beauty of a bird, and tells heavily in any good competition. The gait is slow, and the carriage quiet and dignified.

"The hen is of similar conformation as to shortness, width, and depth of body, the short neck rather tending forward, the high-carried stern, &c. In her, the saddle is exchanged, however, for a still more developed 'cushion,' almost globular in its fulness of outline, and which, with a similarly developed fluff on thighs, are the chief points in a Cochin hen. The tail is very short, and should just peep through the feathers of the cushion. In other points the conformation is similar. In both sexes the toes should be large, straight, and well spread out."

"The colours bred in Cochins are various shades of cinnamon, buff, partridge or grouse, white, black, and "cuckoo."

In keeping Cochins cleanliness is most essential, and the roosting-houses must be kept scrupulously clean. They are much better on broad planks littered with straw than on perches, such board forming a sort of roof to the nesting boxes. As will be seen from the weight, they make excellent table birds. They are fairly hardy, and the hens moderate layers. The hens also are good mothers, and their fluff helps to keep the almost naked chicks warm. I can hardly recommend them as a farmer's fowl, but a few running in a nice green paddock look very handsome, and can with proper attention be made to pay for their keep. The young cockerels are very easily made into capons. They will succeed better in the drier portions of the Colony.

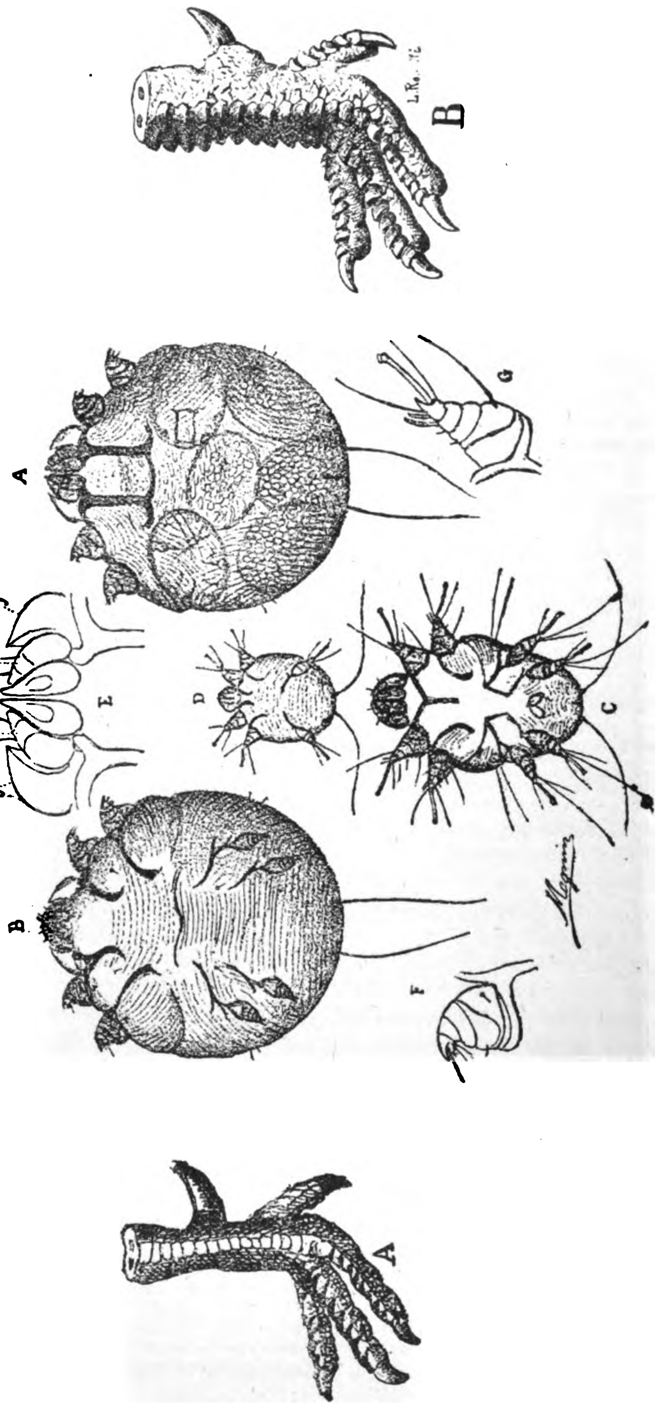
Having already given such a full description, I merely add schedule for colour of Buff Cochins and value of defects in judging:—

COLOUR OF LEMON-BUFF, SILVER-BUFF, OR CINNAMON COCHINS.

In both Sexes.—Beak rich yellow; comb, face, deaf-ears and wattles brilliant red, with as few small, spiky feathers as possible; eyes should match the plumage as nearly as possible, but red eyes are not objectionable; legs bright yellow, with a shade of red between the scales.

Colour of Cock—Breast and under parts any shade of lemon-buff, silver-buff, or cinnamon, provided it be even, and free from mottling; head, hackle, back, shoulders, wings, and saddle any shade of deeper and richer colour which harmonises well—lemon, gold, orange, or cinnamon; the wings to be perfectly sound in colour, and free from mealiness. Tail still darker in tint, but as free from black as possible, except in the darker Buffs and Cinnamons, in which black is not objectionable; white in the tail is very objectionable in any colour except whites.

Colour of Hen.—Body all over of any even shade, free from mottled appearance; hackle of a deeper colour to harmonise, free from black pencilling or cloudiness, cloudy hackles being especially objectionable; tail as free from black feathers as possible. Birds must match in the pen, and in matching different sexes, the hen's body-colour must match that on the cock's breast and lower parts.



SCALY LEG.

VALUE OF DEFECTS IN JUDGING.

Standard of Perfection.	
A bird ideally perfect in shape, size, colour, head and comb, cushion or saddle, leg-feathers, tail, &c., and in perfect health and condition, to count in points	100
If of extraordinary size, add on that account	5

Defects to be Deducted.	
Bad head and comb	10
Want of hackle	5
,, cushion	8
,, fluff	7
,, leg-feather	12
Vulture hocks	5
Bad shape or carriage of tail... ...	6
White in tail (where objectionable)...	6
Primaries out of order	15
Curved toes	7
Stain of white in deaf-ear	6
Faulty colour and marking	24
Want of size	20
,, general symmetry	15
,, condition	12
,, ,, (if total)	35

Our illustration represents a pair of Buff Cochins belonging to the Kingsgrove Poultry Farm Co., which took first prize at the recent Show of the Royal Agricultural Society at Moore Park.

SCALY LEG.

SCALY LEG.

Reference to Plate (page 347).

A. Healthy leg. B. Diseased leg.

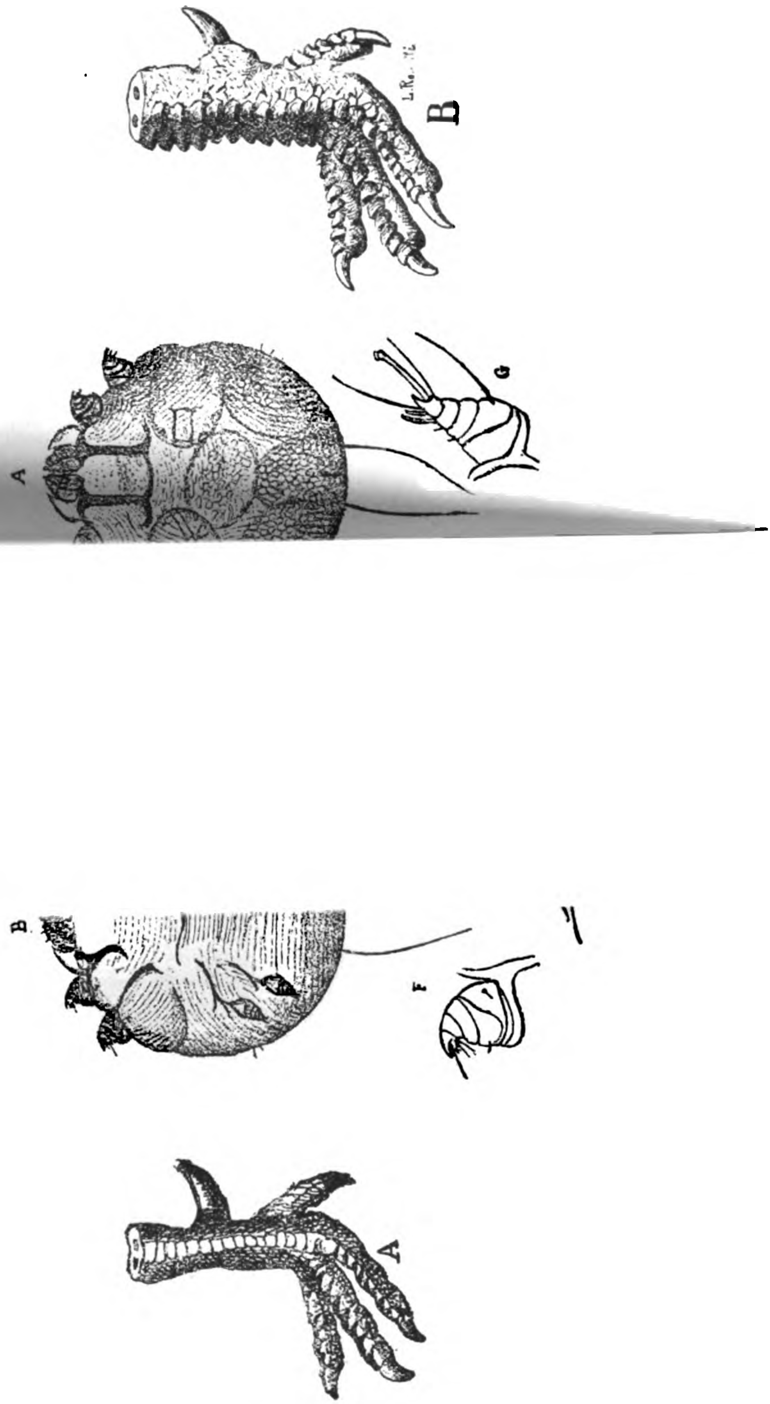
Parasite (*Sarcoptes mutans*) present in the disease known as Scaly Leg.

A. Female front view; B. Back view of ditto; C. The male; D. Six-legged larva; E. Rostrum—mm. mandibles, pp. feelers, jj. cheeks; F. Front leg of female; G. Ditto male, nymphs, and young females.

the fowls an acaridan parasite of a new species, which the latter gentlemen described and illustrated in a very elaborate manner, under the name of *Sarcoptes mutans.* The affection in question was therefore a true scab.

MM. Reynal and Lanquetin, in their notes upon scaly legs, state that it is their opinion that the complaint can commence either at the head or at the legs. This is an error; it commences always at the legs, and it generally remains localised upon them, but not always, as stated by Neumann, who asserts that the scales of the head (comb, &c.) are not due to the same cause as scaly legs; nevertheless, we have had under our observation many instances of true scale, or scab, of the comb, among cocks which were at the same time affected in the legs. These latter had inoculated their heads in scratching with their claws. Scaly legs have also been noticed among turkeys, pheasants, partridges, and even cage-birds, but the heads of these did not appear to be subject to scab.

In his work, La Langshan, from which above illustrations are taken, the author, M. Rouille, says of that variety:—"Like all the Asiatic breeds, it is subject to scaly leg. Reports which we have tried to obtain as to the soils which give rise to this malady to birds have been contradictory." In a footnote M. Rouille says—"Scaly leg is considered by some pathologists to


B
A
G
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VALUE OF DEFECTS IN JUDGING.

Standard of Perfection.

A bird ideally perfect in shape, size, colour, head and comb, cushion or saddle, leg-feathers, tail, &c., and in perfect health and condition, to count in points 100

If of extraordinary size, add on that account 5

Defects to be Deducted.

Bad head and comb	10
Want of hackle	5
,, cushion	8
,, fluff	7
,, leg-feather	12
Vulture hocks	5
Bad shape or carriage of tail... ...	6
White in tail (where objectionable)...	6
Primaries out of order	15
Curved toes	7
Stain of white in deaf-ear	6
Faulty colour and marking	24
Want of size	20
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Our illustration represents a pair of Buff Cochins belonging to the Kingsgrove Poultry Farm Co., which took first prize at the recent Show of the Royal Agricultural Society at Moore Park.

SCALY LEG.

The following note has been kindly forwarded to me by Mr. J. J. M'Cue, of Moorside Poultry Yards, Telegraph Point:—

IN a recent number of the *Eleveur*, M. P. Megin, the expert poultry-fancier, gave some very interesting details concerning scaly leg, upon which I base the following remarks:—For a long time it has been known that poultry are liable to an affection of the legs, characterised by a super-abundance of the scaly secretions of the epidermus, which has the effect of rendering them greatly enlarged and deformed. It has been compared, by some authorities, as resembling an affection which affects many human beings, called *ichthyosis*, in which the epidermus also becomes thick and scaly; but it was only in 1860 that the true nature of this affection was established. M. Reynal, at the time clinical professor at Alfort College, gave some fowls attacked with this complaint to Messrs. Lanquetin and Ch. Robin, for them to study. These savants discovered upon the legs of the fowls an acaridan parasite of a new species, which the latter gentlemen described and illustrated in a very elaborate manner, under the name of *Sarcoptes mutans*. The affection in question was therefore a true scab.

MM. Reynal and Lanquetin, in their notes upon scaly legs, state that it is their opinion that the complaint can commence either at the head or at the legs. This is an error; it commences always at the legs, and it generally remains localised upon them, but not always, as stated by Neumann, who asserts that the scales of the head (comb, &c.) are not due to the same cause as scaly legs; nevertheless, we have had under our observation many instances of true scale, or scab, of the comb, among cocks which were at the same time affected in the legs. These latter had inoculated their heads in scratching with their claws. Scaly legs have also been noticed among turkeys, pheasants, partridges, and even cage-birds, but the heads of these did not appear to be subject to scab.

In his work, La Langshan, from which above illustrations are taken, the author, M. Rouille, says of that variety:—"Like all the Asiatic breeds, it is subject to scaly leg. Reports which we have tried to obtain as to the soils which give rise to this malady to birds have been contradictory." In a footnote M. Rouille says—"Scaly leg is considered by some pathologists to

be a skin disease analogous to psoriasis (Laboultene); by others, as a parasite skin malady caused by acaridæ." Robin, Megnin, Frohner, &c., have discovered as present in the disease *Sarcoptes mutans*, which are capable of localising themselves on any part of the body.

Mr. Vale, an expert authority on diseases of poultry, and pigeons, &c., and a microscopist of recognised ability, says in one of his books (Roup and Kindred Ailments), we find, under head "Scaly Leg," the following:—"Symptoms—An accumulation of epidermic scales upon an inflamed surface. This condition is not due to parasites, as is generally supposed, but to tubercular disease, the cause of the inflammation. All fowls suffering from scaly leg should be destroyed."

That a gentleman of Mr. Vale's experience should have held this theory so lately as within three years is surprising, and shows how easy it is to be mistaken. That scaly leg is a parasitic disease is now well established, as is evidenced by above illustration.

Practical Vegetable-growing.

Directions for the Month of June.

The weather during the month of June is generally cold, and especially so at night, but notwithstanding this there should be vegetables in sufficient quantity for home use. When sowing seed or planting seedlings it would be advisable not to plant or sow the same piece of ground with the same kind of plant or one belonging to the same family. For instance, peas had better not be sown on the same ground where French beans had just been growing. It would be better to use the ground for cabbages, or, perhaps, some root-crop. It is not always practicable to carry out a proper rotation of vegetables, but as far as possible it should be done.

Everyone who has a garden, whether it be for vegetables, fruits, or flowers, should always save the ashes from the fires and spread them over the ground. They had better not be mixed with manure, for, if so, it is not unlikely that some loss may occur. Ashes are useful for several purposes, especially wood ashes. They frequently contain a considerable quantity of potash, one of the most necessary ingredients of all plants. They assist to sweeten the land, keep it open and mellow, and assist, considerably, towards the retention of wholesome moisture in the soil. Everyone who has anything to do with the soil should carefully remember this.

There should be no difficulty for every farmer who grows his own vegetables to collect abundance of good manure for all the requirements of the vegetables. There is nothing better in the world than the droppings of cows, horses, sheep, and fowls, and the liquid portion, if it be possible to retain it, is the most valuable. Pig-manure is objectionable for vegetables, for it sometimes imparts a disagreeable and offensive flavour. Whoever grows vegetables should aim not only to grow them well, but also to grow them with a good flavour, and this can be done by using well-rotted manure. The preparation of manure is by no means difficult. The droppings of the various animals should be well mixed together, and kept to ferment or rot under some sort of shelter, where the rains cannot wash out the best part of the manure. It should not be allowed to become dry, and this can be obviated if all the dish-water and house-washings are emptied over it daily, but it should not be made too wet. A little experience will soon show how to act, and how to make the best of manures. Bones burnt to powder will make a useful addition to the manure-heap. This is perhaps the best and easiest method of using them, for although all the nitrogen will be lost the phosphates will be saved, and this is the principal constituent of bones. When manure is well rotted, most, if not all, of the seeds of weeds which droppings (especially of sheep) are almost certain to contain, will be destroyed. On account of the weed-seeds alone the manure should be rotted.

Readers, of these suggestions for vegetable-growing, who are starting to work for the first time at making a vegetable-garden are advised not to grow their vegetables amongst their fruit-trees. There is always a great temptation to do so, but it is a mistake unless the trees are very young indeed. It is far better to set apart a piece of ground altogether for the vegetables; it need not be very large, but it should be kept clean, thoroughly well cultivated, and constantly under crop. The ground should be well drained, and, if possible, trenched 2 feet deep all over, including paths; and great care must be taken to have an outlet for surplus water, especially if the ground is stiff and of a clayey nature. When it is being trenched the top soil should not be turned over to the bottom, and the subsoil brought to the surface, but it should be managed that the surface soil be kept to the top, and this can easily be done if the matter be well thought over.

Artichoke, Globe.—Some suckers or young plants may be put out during the month, but this may be delayed, if necessary, until nearer spring. It is a vegetable hardly worth the growing, and one that takes up a good deal of space in the garden. Plant the suckers or young plants about 3 feet apart, and if the soil is dry they had better be well watered after planting.

Artichoke, Jerusalem.—This is quite a different vegetable to the above, and in no way related to it and, properly speaking, is not an artichoke at all. It is a native of Brazil. It is a remarkably easy vegetable to grow, and will succeed on almost any kind of soil if it be well dug and well manured with old rotten manure. Over-manuring is apt to cause the stalks to grow too rank, and then the tubers will not be so plentiful. It is an excellent vegetable, as well as a wholesome one, and it should be grown in every vegetable-garden. The tubers had better be planted as soon as they can be obtained, as they will not keep out of the ground for any length of time. Make rows about 3 feet apart, and plant the tubers along these rows about 1 foot apart, and about 5 inches deep. Cover with soil and keep free from weeds. Endeavours are being made by seedsmen in Europe to raise tubers as smooth as possible, and it is most probable their efforts will be successful.

Beans, Kidney.—These may be sown in the warmest parts of the Colony, and only in places free from frosts.

Beans, Broad.—The present month, June, is a suitable time to sow to any extent. This vegetable prefers a stiff soil, but will succeed fairly well in any soil if it be well manured. Sulphate of lime will be found to improve the quality of the beans considerably. Superphosphate of lime is also useful. Manures rich in nitrogen should be avoided,

Cabbage.—Sow a sufficient quantity of seed to meet requirements. Sow also some seed of the red or pickling cabbage, for it will be found to be useful. The pickling may be done without any difficulty. The cabbage should be cut up into fine cross-slices, and covered well with salt for about three days or more. The salt should be rubbed well into the cabbage occasionally. Then place the cut-up cabbage in pickle-jars, and pour in and cover with boiling vinegar. Allow it to cool, and then cork the bottles securely. This may be used at once. Cabbages may be planted out as required.

Endive.—Sow a little seed in the warm parts of the Colony. It is a native of a warm climate, and therefore succeeds well in warm places, although some varieties will grow well almost anywhere.

Carrot.—Sow a few rows of this useful vegetable, and thin out former sowings. The small carrots thinned out need not be thrown away, for they can be used in soups.

Leek.—This is a good, useful, and wholesome vegetable, and should be grown largely. Sow a good quantity of seed in a seed-bed. If any fair-sized seedlings are available, plant them out in very richly-manured shallow trenches. Some of the best varieties are London Flag and improved Musselburg. The trenches should be about 18 inches apart, and the young leeks should be planted deep in the soil, about 9 inches apart. The leek is a greedy feeder, and needs abundance of manure and water to bring it to the greatest perfection.

Lettuce.—Sow a little seed, and plant out strong seedlings from the seed-bed. Remove them carefully, and, if possible, without breaking their roots.

Onion.—Sow a little seed, and attend to seedlings which are coming up from former sowings. They must be kept quite free from weeds. Thin out as the plants become strong. Spread a dressing of soot and salt, half and half, about the young onions.

Parsnip.—Sow a little seed; thin out former sowings, and keep down the weeds as they grow.

Peas.—Sow largely, in rows about 3 feet apart. When the plants are about 3 or 4 inches high stick in some light brush or sticks along the rows for the peas to climb over. Be careful not to make the brush too dense and thick or the plants cannot grow. The seed should be put about 4 inches apart in drills, which should be about 3 or 4 inches deep, but not more.

Herbs.—Divide any old plants and replant.

Salad Plants, such as mustard and cress and radishes may be sown from time to time as required. Tender radishes are always useful, but all that are hard, pithy, or overgrown should be pulled up and thrown to the pigs or chickens.

Orchard Notes for June.

WHEN the land is ready and the trees available, the planting out of new orchards may commence during the month, as the earlier in season the trees are planted the firmer and better established they will become before spring, when they start into active growth. In support of this, I may say that even during the winter the young trees are making root, and this is easily seen in nursery work, where the roots of the trees that are heeled in are often covered with young rootlets that have been formed since the trees were lifted, and which are destroyed when the tree is again removed for planting; so that had these trees been planted out permanently in the first place, instead of being heeled in and then transplanted, the root-growth made would have been available for the tree's requirements when the active tree-growth in spring makes a demand on the roots to supply the necessary moisture and food. In planting out, always take care to obtain well-grown healthy trees having a good root, and yearlings, if possible. Never plant too deep; the depth at which the tree stood in nursery is about the right depth to plant. Carefully examine the roots, and cut off any bruised or broken parts, making a sloping cut from the underside, so that the cut surface comes directly in contact with the soil, when young roots will readily start from it. Dig the holes carefully, and in planting always see that the centre of the hole is kept rather higher than the sides, so that the drainage is from and not to the main trunk of the tree. Spread the roots evenly round the hole, and spread a little of the top soil, which should be kept separate for this purpose when digging the hole, evenly round the roots, and press it firmly so that every root comes directly in contact with the soil, so that there will be no fear of the roots drying out. When planted cut the top of the tree back to the desired height; and this early cutting back has also an advantage, as the buds that are left will become much better developed during the winter than if all the top had been left on. If the tree is properly planted and cut back staking will be unnecessary, and this is always an advantage, as when staked the tree is often more or less chafed by being rubbed by the wind against the stake. If the ground is not ready the preparation of the soil should be proceeded with rapidly. Pruning should be pretty general with all deciduous trees, except the apple, which in the coast districts may not have completed shedding its leaves. I am always in favour of early pruning, as by doing so the energies of the tree are confined to the development of the buds that are left instead of being distributed over the whole. Where the orchard requires liming, it it can be done during the month, and draining where necessary should be attended to. Slowly-acting manures such as bone-meal, ground bones, or boiling-down refuse that has been composted, can be applied to the orchard during the month, and should be cultivated or lightly ploughed in, so that they may become absorbed by the soil and be rendered slowly available for plant-food when required by the trees in spring. The prunings of an orchard should always be carefully gathered up and burnt, as by this means

the spores of many injurious fungus diseases are destroyed; and whenever practicable it is of great advantage to gather up and burn all leaves that have been effected with pear mite, pear scab, apple scab, powdery mildew, or any other surface-feeding microscopic fungus, and all rotting fruit that may be left lying about and covered with the bitter rot. If this is carefully done it will be the means of destroying countless germs of disease, and will be productive of great good to the orchard. The balance of main crop of lemons should all be cut from the trees this month and properly cured, as previously described in the *Gazette*; and the earlier oranges will be ready for market, especially those from the Northern rivers, the fruit grown near Sydney being still more or less unripe and lacking sugar, though there will be a demand for a certain quantity for local consumption and intercolonial trade. Towards the end of the month, however, shipments of the ripest fruit might be prepared for export; but the fruit will have to be of extra quality and well packed. After undergoing a week's curing to toughen the skin, all fruit for export should be carefully wrapped and evenly and lightly packed, and all blemished fruit—no matter how small the blemish may be—should be rigidly excluded.

Our fruitgrowers have had a very good opportunity during the present autumn of seeing how fruit should be got up and packed for export, by means of the cases of Sicilian lemons which have been exposed in our market for sale; and it is to be hoped that they will take a lesson from the Sicilians, for if there is one thing our growers are deficient in above all others—and their faults are not few—it is in the handling, packing, and marketing of their fruit.

General Notes.

The Soils of the Labour Settlements.

The suitability of the soils of the Pitt Town and Wilberforce Co-operative Settlements having been brought into prominence in the metropolitan press, the following analyses by the Departmental Chemist, Mr. F. B. Guthrie, will doubtless prove of interest to readers generally, as well as valuable as a guide to the settlers in cultivating the areas of which they are typical.

Pitt Town.

The soil is a sandy loam, having a capacity for water of 32 per cent., and an absolute weight per acre, 6 inches deep, of 2,562,206 lb. A mechanical analysis shows that it contains of root fibres, ·20 per cent.; stones over ¼ inch in diameter, ·41 per cent.; coarse gravel more than 1/16 inch in diameter, 6·35 per cent.; fine gravel more than 1/50 inch in diameter, 7·91 per cent.; fine soil, 85·13 per cent., comprising sand, 45·68 per cent., and impalpable matter, chiefly clay, 39·45 per cent. An analysis of the fine soil discloses moisture, 1·742 per cent., and volatile and combustible matter, principally organic, 5·107 per cent. The fertilising substances soluble in hot hydrochloric acid of 1·1 specific gravity consist of lime, ·093 per cent., the general value of which is fair; potash, ·112 per cent, general value satisfactory; phosphoric acid, ·053 per cent., general value fair; nitrogen, ·188 per cent. (equal to ammonia, ·204 per cent.), general value satisfactory; ferrous oxide, ·180 per cent.

In his general remarks Mr. Guthrie says: "This analysis is made on samples 7 and 8 mixed together, as being typical of the largest area. The soil, though not particularly rich, is not deficient in fertilising materials, is in fair mechanical condition, and does not contain any injurious ingredients. It would benefit by draining and the addition of lime; about ½ ton per acre would improve it. Good farmyard manure would probably be sufficient for most crops, with additions in the way of special fertilizers for special crops; about 4 cwt. of bone-dust per acre for maize, hay, and vegetables."

Wilberforce.

This settlement forms a portion of Wilberforce Common, the soil being a sandy loam, having a capacity for water of 29·6 per cent., and an absolute weight per acre, 6 inches deep, of 3,008,118 lb. A mechanical analysis shows that it contains of root fibres, ·14 per cent.; stones over ¼ inch in diameter, ·00 per cent.; coarse gravel more than 1/16 inch in diameter, ·00 per cent.; fine gravel more than 1/50 inch in diameter, ·62 per cent.; fine soil, 99·24 per cent., comprising sand, 72·02 per cent., and impalpable matter, chiefly clay,

27·22 per cent. An analysis of the fine soil discloses moisture, 1·019 per cent.; volatile and combustible matter, principally organic, ·110 per cent. The fertilising substances, soluble in hot hydrochloric acid of 1·1 specific gravity, consist of lime, ·112 per cent., general value satisfactory; potash, ·003 per cent., general value bad; phosphoric acid, ·043 per cent., general value indifferent; nitrogen, ·077 per cent. (equal to ammonia, ·093 per cent.), general value fair; ferrous oxide, ·216 per cent.

In his general remarks Mr. Guthrie says: "The analysis was conducted on No. 2, which appears typical of the largest area. This is a poor soil, inclined to be sour, and would require draining, liming, and liberal dressings of manure before the best results are obtainable. It is in fair mechanical condition. For special crops, especially roots and grain, it will require the addition of manures containing phosphoric acid and potash. Speaking generally, plenty of bone-dust and about 2 cwt. of kainit per acre will benefit it considerably. The almost total absence of potash is quite remarkable."

A Prolific Wheat.

In response to an inquiry by Messrs. Haywood Bros., of Pambula, the Department recommended the growth of Galland's Hybrid wheat for poultry-feed, both on account of its rust-resisting qualities and its prolificness. The following letter, dated 12th March, 1894, has been received from Messrs. Haywood:—"You will remember we wrote for particulars and information last May regarding the most suitable varieties of rust-resisting wheat to grow for poultry-feed. In reply, Galland's Hybrid was mentioned in particular. Your Department sent us shortly afterward half a bushel of the above-named wheat, which was carefully sown, on the 30th May following, on a rich piece of alluvial land adjoining the Pambula River, about one-fifth of an acre in extent. Before sowing we calculated that at least one-third of the wheat was destroyed by weevil; so we planted it a little thicker. However, it came up very thin—certainly not half as thick as it should be for a crop. It stooled out well, and grew rapidly to a height of 6 feet, and was harvested the first week in January last, when it could be easily seen that there was ample room for twice the crop on the same piece of land. The season was unusually wet from the time of sowing up to the time it was reaped, and not a sign of rust could be noticed. From one-fifth of an acre we have just threshed 8 bushels of seed, and we intend sowing the whole of it for seed purposes. We may state that we have never grown such a wonderfully prolific cereal excepting maize. Its large ears of heavy grain hang down almost half way to the ground. The straw was used for thatch. As we have gone into poultry and egg farming this variety of wheat will certainly be of the greatest value to us, because of its rust-resisting qualities and its prolificness. No farmer should be without a few acres."

Reference is made to this variety of wheat in Vol. IV, p. 468, where it is stated:—"Galland's Hybrid is an enormously prolific, hardy, rust-resistant, mid-season or somewhat late variety. It has been known to yield 90 bushels to the acre. The grain is very inferior for flour, and is used for fowls. In appearance this variety resembles Algerian, and to a less extent the larger Durums, such as Xeres. It is grown in many parts, but not extensively. It will flourish on poor soil, and with little attention."

THE PREVENTION OF PHYLLOXERA.

In a communication addressed recently to the *Sydney Morning Herald*, Mr. Henry Bonnard, of Vitis Park, near Richmond, urges upon vine-growers the necessity for treating their vines during the winter with the following mixture, recommended by "The High Commission against Phylloxera" in France, as a means of destroying the winter egg. The mixture for 1,000 vines is prepared by dissolving in 50 or 60 gallons of water 25 to 30 lb. of sulphate of iron, to which may be added a few pounds of sulphuric acid, or better, a few pounds of sulphuret of potash. Then wash, or mop carefully, the whole of the old wood of every vine below the wood of the year with a paint or whitewash brush. The wood will soon look as black as if charred, and as the solution will damage the linen, clothing, and boots of the operator, he should not wear his best suit for the occasion.

In a report on the above-mentioned communication, Mr. J. A. Despeissis, Consulting Viticulturist to the Department, says:—"The solution is the same which has been for a couple of years or more recommended by the Department as a preventive against anthracnose or black spot on the grapes, and I have no doubt that if brought into contact with the phylloxera, its winter egg, or any spores or parasite on the vine, it would destroy them speedily.

"In this matter, however, united and wide-spread action would be required, and the application would have to be very thorough, and extend to the old wood and the whole of the stem, instead of being confined, as in the case of anthracnose, to the younger wood of the previous year.

"This treatment, if not an absolute guarantee of the destruction of the phylloxera on the vine, would, however, be productive of much good in many respects. It is cheap, would save the crop from the attack of anthracnose; would destroy a considerable number of the spores of the oïdium, as well as larvæ of insects destructive of the vine, and also annihilate, by contact, the winged form of the phylloxera, or its egg, and would bring each stock of vine more directly under the notice of vine-growers and vine-dressers, who would thus be better able to notice at the start any possible invasion of the vine by the pest, and thus take prompt measures to stop its further encroachments."

AGRICULTURAL SOCIETIES SHOWS, 1894.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindale	Jan. 9, 10.
Clunes Agricultural Society	J. W. Brown ...	,, 17, 18.
Albion Park A. and H. Association	T. Armstrong ...	,, 17, 18.
Kiama A. and H. Association	J. Somerville ...	,, 25, 26.
Holt-Sutherland H. and I. Society	W. Douglas ...	,, 26.
Wollongong A. and H. Association	A. J. A. Beatson...	,, 31, and Feb. 1
Berry A. and H. Society	A. J. Colley ...	Feb. 6, 7, 8.
Gosford A. H. and I. Association...	H. S. Bevrendge...	,, 9, 10.
Luddenham A. and H. Association	K. Campbell ...	,, 13, 14.
Manning River (Taree) A. and H. Association ...	W. Plummer ...	,, 14, 15.
Lithgow A. and H. Society	M. Asher	,, 15, 16.
Shoalhaven (Nowra) A. and H. Association ...	R. Leeming ...	,, 15, 16.
Marulan P. and H. Society	H. Morrice ...	,, 23.
Kangaroo Valley A. and H. Society	H. Joyce	,, 25, 26.
Candelo A. and H. Association	C. H. Brooks ...	,, 27, 28.
Tumut A. and P. Association	W. H. Bridle ...	,, 27, 28.
Tenterfield P., A., M., and H. Society	J. Harker... ...	,, 27, 28, and Mar. 1.
Port Macquarie A. and H. Society	A. E. Poutney ...	,, 28 and Mar. 1.
Lismore A. and H. Society...	C. S. Connor ...	,, 28 and Mar. 1, 2.
Berrima District (Moss Vale) A., H., and I. Society	J. Yeo	Mar. 1, 2, 3.
Nepean District (Penrith) A., H., and I. Society	R. Benaud ...	,, 1, 2, 3.
Robertson Agricultural Society	R. J. Ferguson ...	,, 6, 7.
Uralla P. and A. Association	J. D. Leece ...	,, 6, 7.
Bega A. and P. Association	A. J. Wilson ...	,, 7, 8.
Inverell P. and A. Association	J. M'Ilveen ...	,, 8, 9.
Picton Agricultural Society	G. Bradbury ...	,, 8, 9.
Cobargo A. and P. Society	J. Graham ...	,, 13, 14.
Tumberumba P. and A. Society	W. Willans ...	,, 13, 14.
Glen Innes P., A., and M. Association	J. Denshire ...	,, 14, 15.
Goulburn Agricultural Society	J. J. Roberts ...	,, 15, 16.
Gulgong Agricultural Association...	S. Turner... ...	,, 16, 17.
Armidale (Combined Show), A. and P. Association	W. H. Allingham	,, 20, 21, 22.
Taralga A. and P. Association	J. J. Walsh ...	,, 21, 22.
Royal Agricultural Society (Sydney)	F. Webster ...	,, 21 to 27.
Braidwood P. and A. Association...	G. F. Taylor ...	,, 22, 23.
Castle Hill A. and H. Association	F. H. G. Rogers...	,, 26, 27.
Orange A. and P. Association	J. S. Thomas ...	,, 28, 29.
Walcha P. and A. Association	H. Chapman ...	April 4, 5.
Lower Clarence (Maclean) Agricultural Society...	J. S. Dunnet ...	,, 4, 5.
Camden A., H., and I. Society	W. R. Cowper ...	,, 4, 5.
Gundagai P. and A. Society	W. E. Kyle ...	,, 5, 6.
Blayney P. and A. Association	G. H. Woolly ...	,, 5, 6.
Gundaroo P., A., and H. Association	J. Affleck... ...	,, 6.
Namoi (Narrabri) P., A., and H. Association ...	J. Riddle	,, 11, 12.
Bathurst A., H., and P. Association	W. G. Thompson..	,, 11, 12, 13.
Clarence (Grafton) P. and A. Society	T. Page	,, 18, 19.

Society.	Secretary.	Date
Wellington P. and A. Association	R. Porter	April 18, 19.
Hunter River (West Maitland) A. and H. Association	W. C. Quinton ...	„ 18, 19, 20.
Dubbo P., A., and H. Association...	G. H. Taylor ...	„ 24, 25, 26.
Warialda P. and A. Association	W. B. Giddes ...	„ 25, 26.
Mudgee Agricultural Society	J. M. Cox ...	„ 26, 27.
Macleay (Kempsey) A. and H. Association ...	H. R. Gray ...	May 9, 10, 11.
Gwydir (Moree) P. and A. Association	J. G. Cohen ...	„ 9, 10.
Upper Hunter (Muswellbrook) A. and H. Association	Price Healey ...	„ 16, 17.
Upper Manning (Wingham) A. and H. Society...	J. J. Herkes ...	„ 16, 17, 18.
Hornsby, Thornleigh, Pennant Hills, &c., H. Association	H. Epthorp ...	„ 23, 24.
Cumnock P. and A. Association	W. Newmarch ...	„ 24.
Warren P. Association	F. C. Thompson ...	June 7, 8.
Cobar P. and A. Association	A. Roxburgh ...	„ 13, 14.
Riverina (Jerilderie) P. and A. Society	J. Fulton... ...	July 24, 25.
Forbes P., A., and H. Association...	W. G. Dowling ...	Aug. 9, 10.
Northern (Singleton) Agricultural Association ...	C. Poppenhagen ...	„ 15, 16.
Cowra P., A., and H. Association...	S. Wright... ...	Sept. 5, 6.
Burrowa P., A., and H. Association	J. F. Clifford ...	„ 13, 14.

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[4 plates.]

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THE

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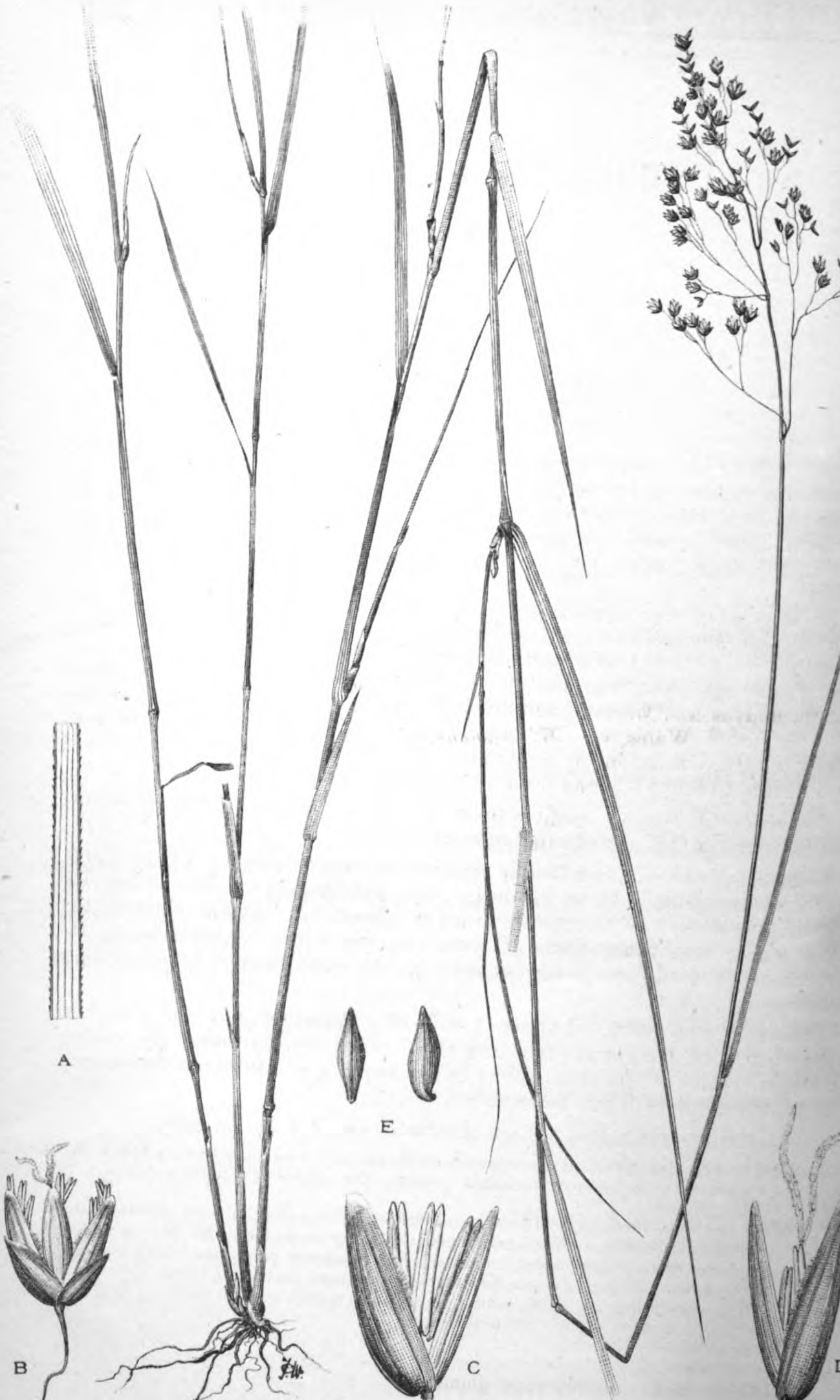

Hierochloa rariflora, Hook. f.

"A Scented Grass."

(11659-94)

Useful Australian Plants.

By J. H. MAIDEN,
Consulting Botanist.

No. 11. A Scented Grass.

(*Hierochloa rariflora*, Hook. f.)

This is one of the very few grasses of New South Wales which are sought after as perfumes rather than as fodder-plants. In fact, it is the perfume-grass *par excellence* of this Colony, and it is so often brought to Sydney as a curiosity, that it is well to examine into it. By reputation, at least, it is a very well-known grass, but most people have but a nodding acquaintance with it.

It belongs to the genus *Hierochloa*, which comprises from eight to thirteen species, according to the views of different botanists. Bentham describes it as "an Arctic and Antarctic genus common to the New and Old World, extending into more temperate regions in Europe, South Africa, the Himalayas, and Mexican mountains." We have two species of *Hierochloa* in New South Wales, viz., *H. redolens*, and *H. rariflora*. They are very nearly related, but as, in my experience, the latter is more commonly met with in this Colony, I have chosen it first for description.

Vernacular Names.—Usually known as "Scented Grass," but sometimes also as "wire grass," for obvious reasons.

Botanical Name.—*Hierochloa* or *Hierochloe*, from two Greek words, *hieros*, holy; *chloe*, grass. It is generally and properly spelt *Hierochloa*, but Gmelin, the author of the genus, wrote it *Hierochloe*. *Rariflora*, from two Latin words signifying thin or loose (inflorescence), in allusion to the panicle. The word *rarus* is the opposite of the word *densus*, which signifies dense.

Botanical description.—I think it will be a convenience to many to have a description of the genus preceding the detailed description of the species. If other species of the same genus be subsequently described, the description of the genus will not be repeated.

Genus *Hierochloa* (*Flora Australiensis*, Vol. VII, p. 559).

Spikelets with one terminal hermaphrodite flower and two male flowers below it, in a pyramidal or narrow terminal panicle, the rachis articulate above the two outer glumes.

Glumes 6, thinly scarious, *two outer* acute-keeled with a more or less distinct short nerve on each side. *Third and fourth* obtuse or emarginate, the keel sometimes produced into a short awn, each enclosing a narrow palea and three stamens; *fifth*, shorter, broad, obtuse, five-nerved, the keel rarely produced into a short point, enveloping the *sixth*, which is narrower with a central nerve or keel. No two-nerved palea to the terminal flower.

Stamens—Two.

Styles—Distinct.

Grain—Enclosed in the two upper glumes.

H. rariflora.

Stems.—Slender, branching, 2 to 3 feet high.
Leaves.—Narrower than in *H. redolens*, tapering into long subulate points.
Panicle.—Loose and spreading, 2 to 3 inches long.
Spikelets.—All on slender pedicels, often variegated from the contrast of the purpli outer glumes and pale-coloured upper ones.
Glumes.—*Outer persistent glumes* broad, obtuse, the lowest about $1\frac{1}{2}$ lines long, t second rather large and three-nerved; *intermediate male glumes* about two lin long, rather rigid, five-nerved, obtuse, and awnless, finely and shortly cilia on the margins, and sometimes on the keel.
Fifth glume.—Very broad, thin, obtuse, glabrous, five-nerved.
Sixth glume.—Much narrower, keeled, but the lateral nerves scarcely visible.

Dr. (now Sir Joseph) Hooker, who first described this grass from Tasmanian specimen, speaks of it as "a very distinct species, conspicuous f its slender, branched, leafy, knotted culms, 2 to 3 feet long, its narrow, stri rigid leaves rough to the touch, and small loose panicles of small spikele on long flexuous branches." This is a brief popular description which cou not readily be improved upon.

Size and habit.—Two to three feet, and even more, in exceptional instance Not erect, but wiry and straggling.

Relative abundance.—While it is not rare in the cold moist, mountainou regions of the south-east of the Colony, it does not appear to be abundant grass in any locality.

Value as fodder.—We have practically no data as to the specific fodde value of our scented grass, and therefore we must fall back upon co parisons with other grasses belonging to the same genus. All *Hierochloas* ha a certain value as sweeteners of musty or other hay, the pleasant odo they impart being grateful to most herbivorous animals. But I express t opinion at once that our scented grass is of no agricultural importance. is true that it is probably fairly nutritious, but its foliage is sparse, the wh plant is wiry, the seed is less abundant than in the other Australian (and most other) species; and, supposing for a moment that anyone in the Colo thinks of propagating it, the warning of Mr. Fletcher, of Canada, as to t tendency of a closely-related species to become (in Manitoba) a noxio weed, should be borne in mind.

Speaking of a native *Hierochloa*, Mr. Bacchus states, "I am aware th stock eat the grass, but know nothing of its merits for grazing."

Baron von Mueller (*Select Extra-tropical Plants*) recommends the Au tralian *H. redolens* as worthy of dissemination on moist pasture land, a recommends *Hierochloas* in general as particularly appropriate for co wet, moory grounds.

We will now inquire what is the opinion held in regard to *Hierochloas* older countries.

Under the name of *Holcus odoratus*, there are some interesting notes *Hierochloe borealis* in Sinclair's *Hortus Gramineus Woburnensis* (2nd E p. 167). There are some data as to the product per acre of this grass, dri and green, and at different seasons. Mr. Sinclair proceeds, "Though th is one of the earliest flowering grasses, it is tender, and the spring produ of herbage is very inconsiderable, the flowering straws rising up in a mann destitute of leaves. This deficiency of produce is much to be regretted, the nutritive qualities of the grass are greater than in most of the ear spring grasses; it sends forth but a few flower straws, which are of slender structure, compared with the size of the leaves. In no instanc that I have observed was this grass eaten by the hares and rabbits whic

preyed upon many of the other grasses. The powerful creeping roots of this grass, its tender nature, and the great deficiency of foliage in the spring, are demerits which discourage the idea of recommending it further to the notice of the agriculturist."

H. borealis is dedicated to the Virgin Mary on account of its sweetness, and is strewn about Catholic Churches in Northern Europe on festival days. Hence the name Holy Grass. The odour it emits is much more powerful when it is trampled upon. It is often called Vanilla Grass on account of its perfume. This is the grass stated by Don to be indigenous to Scotland, as well as to Sweden, Norway, &c. No one else found it in Scotland, and it was dropped out of lists, until Robert Dick, the baker botanist and geologist of Thurso, rediscovered it in that country, and an account of the discovery is pleasantly recounted by Samuel Smiles in his life of that worthy.

Hierochloa borealis is common along the streams and rivers in the mountainous districts of Montana, U.S.A., frequently occupying extensive areas to the exclusion of all other grasses.—(Prof. Scribner, quoted by Dr. Vasey.) Dr. Vasey says that this grass is known in the United States as Vanilla or Seneca grass, and Holy Grass. "It is a perennial grass of northern latitudes, growing in moist meadows near the coast, also in low marshy ground in some parts of Illinois and other States bordering the great lakes, and in the mountains of Colorado and northward. . . . In our country it does not appear to be adapted to general cultivation."

According to Mr. James Fletcher (*Bulletin* No. 19, *Central Experimental Farm, Ottawa*), this grass is known in Canada as Indian Hay, and he makes the following observations in regard to it:—"When cut or fed off, it keeps continually producing young leaves. When once established, however, it is very peristent, and in Manitoba is rapidly becoming a noxious weed most difficult to eradicate. It cannot, therefore, in any case be recommended for cultivation there, and should be introduced everywhere with caution. Our analyses prove it to be a very rich grass. Horses and cattle eat it readily.

"This is the grass of which the leaves are used by the Indian women to weave the scented 'Indian hay' baskets and mats."

No analysis of our scented grass has yet been made. It will therefore be useful to peruse the two accompanying analyses of *H. borealis*. No. 1 is a Canadian grass, gathered with the seeds half ripe. No. 2 is from the United States. It will be observed that the Canadian specimen was very moist. The albuminoids (the flesh-forming constituents of plants) are unusually high.

	In Fresh or Green Material.						Calculated to Water-free Substance				
	Water.	Ash.	Albuminoids.	Fibre.	Nitrogen—Free Extract.	Ether Extract (Fat).	Ash.	Albuminoids.	Fibre.	Nitrogen—Free Extract.	Ether Extract (Fat).
No. 1 ...	75·32	1·64	4·93	6·14	10·68	1·29	6·63	20·00	43·25	24·88	5·24
No. 2 ...	14·30	7·99	12·12	19·73	43·28	3·48	9·32	14·15	23·02	49·45	4·06

Other uses.—None, except that there would be a limited sale for small baskets and other plaited work made out of it.

Coumarin. — Our grass, in common with the closely-related *Anthoxanthum odoratum* (Sweet-scented Vernal Grass), owes its pleasant odour,—the fragrance of new-mown hay in fact,—to the presence of an aromatic body called *Coumarin.* Coumarin is contained in Tonka Beans to a large extent, in the bark of Coachwood (*Ceratopetalum apetalum*), and other trees; in Melilot (*Melilotus*) of various species, Woodruff (*Asperula odorata*), certain *Adiantums* (Maiden-hair ferns), and other plants too numerous to particularise. It is therefore desirable to have a few particulars as to what Coumarin is. It consists of white silky crystals (needles), whose chemical composition is represented by the formula $C_9H_6O_2$. It is remarkable that in most plants that contain it, the Coumarin is only developed, at all events in quantity, after the plant ceases to grow. For instance, Tonquin Beans are nearly inodorous when growing on the tree, while our *Hierochloe* develops far more Coumarin when made into hay than when growing.

Habitat and range.—It is endemic in Australia (New South Wales, Victoria, and Tasmania). In the *Flora Australiensis*, the New South Wales locality given is Twofold Bay. I have received it from Mount Substitute, near Bombala, from Cooma, and other localities in the Monaro, where it is by no means rare; also from the Dromedary Mountain, the Sugarloaf Mountain, near Braidwood, and Bolaro Mountain, near Nelligen, which is the most northerly locality for it up to the present. I should not be surprised if this grass were eventually found in the highest parts of the New England ranges.

Reference to plate.—A, barbed appearance of the margins of the leaves, causing them to be rough to the touch; B, spikelet, showing two male flowers at the side, and one hemaphrodite flower in the middle and above the other two; C, a male flower; D, hemaphrodite flower; E, grain or seed. All variously magnified.

Colonial Timbers for Wine-Casks.

By J. H. MAIDEN.

I DRAW attention, in a tentative way, to the subject of indigenous timbers for cask (and particularly wine-cask) making. The subject is not free from difficulty, for in Europe the best woods for casks have only been found out as the result of many experiments and long experience. Ours is a new country, and we cannot gain experience in a moment; moreover, money is not sufficiently plentiful to enable one to risk the quality of a large quantity of wine in trying experiments on many timbers. But with our admittedly wonderful variety of native timbers, it would be a most extraordinary thing if we have not among them some timbers which satisfy all the desiderata of a good wine-cask. I would go further, and say that such a thing must be impossible. So much being premised, we want to find the best timbers for the purpose. I proceed to give a few notes in regard to timbers most of which have been more or less tested for wine-cask making. I hope it may be suggestive, and that it may result in the Department being furnished with hints on the subject by vignerons, coopers, and others. The Department is only too anxious to aid the important wine industry of the Colony, in helping those engaged in it in regard to this very important question. There ought to be no insuperable difficulty in having small casks made of various woods, and wine placed in such casks, to be examined by experts in the subject.

Mr. Hubert de Castella, the well-known Victorian vigneron, in giving evidence before the Vegetable Products Commission of that Colony states, "I do not think lightwood is a very good wood for casks; it gives a slight taste; I tried lightwood; I had thirteen large casks made from lightwood, and we exchanged them for oak. Even after a year or two, and wine had been in it, we thought it gave a slight taste to the wine—an oily taste."

Subsequently, Mr. de Castella said, "On a former occasion I made a few remarks on casks, a subject which is of the greatest importance to the wine industry of this country. I was in hope that this might have provoked some discussion, but in this I have been disappointed; and now again I venture to urge the importance of the matter............I have used blackwood since 1863, and found it in every respect equal to oak. By blackwood I do not mean what is often supposed to be the same, namely lightwood, which is utterly unsuitable for wine, though good enough for tallow..............Mr. Ransome, one of the judges of Australian timbers at the last London Exhibition, recommended mountain ash as suitable for cooperage; and I have been told that this wood is largely used at Albury. There again a vast difference must be made in favour of what is called blackbutt, which is quite different timber from the mountain ash, as between blackwood and lightwood...........When I first began to make the casks, oak was the only timber supposed to be used. There was not a plank of oak in all the

Colonies. Mr. Higginbotham was making railway carriages and he said 'Why not use blackwood, as we do in the Railway-works?' and I got a couple of planks and made a cask of 130 gallons, and I made big casks, 1,500-gallon casks, and it is an excellent wood. And then the mountain ash has to be tried. There is some prejudice against those things. In England some people say they will not have the wine in any cask except Baltic oak............I asked when I was buying staves, whether there was any difference between blackwood and lightwood, and the timber-merchant showed me that if you crosscut the wood, the blackwood is as hard as horn and the lightwood porous. As the cooper puts his mouth to it his breath comes through. The one is useless for wine and the other is excellent, but the coopers do not know that generally."

As regards the blackwood and the lightwood of which Mr. de Castella speaks, I would invite my readers to the article on blackwood in the *Gazette* for March, page 129, where the subject is discussed, so that I need not repeat myself here.

Speaking of mountain ash, Mr. H. de Castella says, "I have tried to put new wine in mountain ash, which is a very good wood; it has not given any taste to the wine, except that those casks being made by a cooper who bent the staves with fire, the mountain ash, from being charcoaled a little inside, gave a slight taste."

Mr. de Castella speaks highly of mountain ash, and even more highly of blackbutt. Now the mountain ash is probably that very tall Victorian tree which is botanically ranked under *Eucalyptus amygdalina*. This is best known as an oil-yielding species; but it may be *Eucalyptus Sieberiana* which is well known in New South Wales as a mountain ash. It has a bark which at a little distance may be mistaken for an ironbark, but the branches are, unlike those of ironbarks, perfectly smooth. It is common in cold mountain regions, chiefly in the southern coastal districts. Whether this is the mountain ash referred to by Mr. de Castella or not, it is a grand timber, pale coloured, an excellent splitter, and a sound, durable, strong timber. I would strongly recommend that it be given a thorough trial for wine-cask making.

Again, it may be a mountain ash sometimes known as white ash which is found in the highest mountain ranges in the direction of Candelo to Kiandra and the extreme southern portion of the Colony generally. This is a beautifully clear, straight-grained, white timber, which is at present brought to Sydney in small quantities as a substitute for American ash, and it is used to some extent for bed-room furniture. At present it costs a good deal for carriage, but it is a first-class timber, and is, I should think, likely to be eminently suitable for wine casks. If the matter be inquired into I have no doubt we shall find this timber in more accessible localities.

As regards the blackbutt, if Mr. de Castella is reported aright, it must be our old Sydney friend *Eucalyptus pilularis*. But if you want to see really fine blackbutts go to Termeil, between Ulladulla and Bateman's Bay, and other localities on the South Coast. There you will find very giants, both as regards height and girth, and they will split as straight and as true as good stringybark.

But, to return to Mr. de Castella's evidence, it is not perfectly clear because of the use of vernacular names. I have shown that there are various mountain ashes, and when he speaks of blackbutt, it is quite possible that he is speaking of a very black-butted mountain ash, such as *Eucalyptus Sieberiana*, in comparison with the smooth barked mountain ash known to botanists as *Eucalyptus amygdalina*. When the use of vernacular

names (particularly in regard to Eucalypts), causes a feeling of uncertainty as to the timber referred to, is it a wonder that botanists look forward to the millennium, when everybody will use botanical terms for the purpose of designating timbers, because the advantages of their use are so evident? That botanical names are hard to get hold of is a popular error, as erroneous as it is widespread.

Mr. William Graham, also giving evidence before the Victorian Royal Commission on Vegetable Products, says: "The native woods seem to be very good for wine casks, but we have not tried them to any extent. I think blackwood is the best colonial wood for casks. Mountain ash has been used, and has been fairly successful, but not to any great extent. Casks from Tasmanian silver wattle look very well."

It will be observed that both Mr. de Castella and Mr. Graham appear to think that blackwood is the best colonial timber for wine casks. Small blame to them, for they are Victorians, addressing a Victorian Royal Commission, and blackwood is a common timber far better known in Victoria than in this Colony. We have a far better assortment of timbers than our good friends over the Murray, and surely we do not lack the enterprise necessary for taking advantage of our good fortune.

Mr. Graham cautiously refers to casks of Tasmanian "Silver Wattle" as *looking* very well. I am afraid we want something else in wine-casks than good looks; but if anyone in New South Wales wishes to try silver wattle we have plenty of it. Its botanical name is *Acacia dealbata*. Other New South Wales wattles I would like to draw attention to in this connection are the black wattle with broad, two-veined leaves (phyllodia), whose botanical name is *Acacia binervata*. It is plentiful in the coast districts, grows to a large size, and the mature wood is dense. Then we have the mountain hickory, which is abundant in the mountainous districts of the South. It attains a large size and its timber is an excellent substitute for the true blackwood. Its botanical name is *Acacia peninervis*. Then I would doubtfully suggest the brigalow (*Acacia harpophylla*) of which a good deal is to be found in the Narrabri District. It is a dense, valuable timber and might be tested by the wine-growers along the Northern line of railway.

Perhaps the New South Wales timber which has been spoken of more than any other for wine-casks is the silky oak (*Grevillea robusta*), which grows in the northern brush forests. At one time it was far more extensively used for tallow-casks than it is now, but a number of experiments have been made with the view to give it the more dignified employment of wine-storage. Mr. Thomas Hardy of South Australia placed shavings of this wood in light wines for two months without affecting the taste and colour of the latter. He pronounced the wood suitable in other respects, and therefore suitable for casking wine. The opinion of an authority so eminent must carry great weight, and I am therefore surprised that I have not heard of the matter being followed up during the last three or four years. Silky oak would not leak when split on the quarter, and Mr. Hardy has been instituting inquiries as to whether the staves would leak when the wood was cut across the grain. I have not heard the result of these inquiries. Mr. Charles Moore, Director of the Botanic Gardens, pronounces silky oak too porous to hold such liquids as spirits.

Now that *Grevillea robusta* is getting scarce, I would like to draw public attention to what I believe to be a perfect substitute for it. The commonest tree in the Dorrigo Forest Reserve is one known to botanists as *Orites excelsa*, and its wood usually passes as silky oak. I examined the timber carefully in the forest, and brought a few pieces to Sydney. Everybody I have shown

them to pronounces them to be silky oak. At the present time, if there is any difference between this *Orites excelsa* timber and that of *Grevillea robusta*, I do not know what it is, and it is evidently not of a superficial character. I was pleased to make this discovery, as there is a perfect mine of this silky oak in the Dorrigo. There are millions upon millions of feet of it, and at present not a stick is used. But even if it be not used for wine-casks the time will come when it will be used for butter or tallow-casks, or for some other humbler yet useful purpose.

I desire now to draw attention to a timber for wine-casks which I had not thought of for the purpose until Mr. Thomas Bawden, of Grafton, kindly brought it under my notice. His remarks on such a subject demand respect, for, as is well known, he has given a good deal of attention to the utilisation of our native products during the last thirty years and more. Mr. Bawden says, "With regard to wine-casks, and the proper wood for the purpose, I think you will find rosewood the very best. I know some years ago the late Richard Bligh had some large vats and casks made of that timber, which suited admirably, and certainly gave no taste to the wine. I yesterday asked an old wine-grower of large experience what he thought best for wine-vats or casks, and he at once selected rosewood, as giving no taste of a deleterious character to the wine. He has tried silky oak, but has condemned it, and has not been able to get anything better than rosewood." I replied expressing doubt that an odorous wood, of the nature of rosewood, would not affect the bouquet of wines stored in it. In a recent letter Mr. Bawden writes,—"With regard to the rosewood for casks, I have the assurance, in addition to my own large experience, of one who has been engaged in wine-making in this district for the past thirty years, that the wood does not give any taste to the wine. Might I suggest an experiment of a small piece of seasoned rosewood placed in a bottle of wine for a few months? Should the rosewood turn out as I believe it will, there are large quantities of it in this district." I venture to express the hope that those who have tried rosewood for wine-casks will relate their experience, and that those will test it who have facilities for so doing and have not yet done so. It is high time that such an important matter were settled. The botanical name of the rosewood referred to is *Dysoxylon Fraserianum*, and I should also like to see exhaustive tests made of the red bean (*D. Muelleri*) which may be described as a scentless rosewood. Who will take the matter up? In the Dorrigo Forest Reserve (not to mention other northern forests) there is an enormous quantity of mature rosewood, and at the present time an axe is never put in it. Just now things are so bad with the unfortunate timber getters, that rosewood may be had at a very low rate. It behoves patriotic people to do their level best to encourage the use of colonial timbers. At present a timber is looked askance at, in many quarters, simply because it is colonial. But this should not be. Surely an educated public is discriminating enough to know a good timber and value it on its merits.

This article is already of sufficient length, and I will therefore content myself by alluding to only one more timber. I have heard native beech (*Gmelina Leichhardtii*) spoken of in the highest terms as an excellent timber for wine-vats. Is there any drawback to its use? If so, what is it?

And if all these timbers I have mentioned be found unsuitable for wine-casks, I will mention some more, for if public spirited men can be found to thoroughly test the timbers, I am determined that they shall not lack likely woods to experiment upon.

Our Timber Trees and Forest Culture.

By W. MacDONALD,
Forester.

Introductory.

My paper is compiled partly from my own practical experience and observation, and partly from the better experience and scientific researches of others. I now submit in the hope that it may, at least, prove readable to those who take an interest in forestry and arboriculture.

Destruction of Timber.

In view of our present abundant supply of timber we often lose sight of the future, but let us consider our present output and fast increasing demands, combined with the enormous quantity of timber which is being destroyed by ringbarking and the clearing of land, and that which is ruthlessly destroyed throughout the Country, of this we can form no estimate, but if complete statistics could be compiled some startling facts would be disclosed. What we daily observe in our own immediate surroundings affords us ample proof that no natural growth can possibly keep pace with the axe and present disastrous warfare of extermination, and under such circumstances it cannot be considered premature to advocate

Forest Conservancy.

Not only should our native forests be thinned out, cleared of useless timber and deadwood, and annually maintained in various eligible sites throughout the country, but I am of opinion that it should be imperative on the part of individual landowners, and more particularly those of large estates, to have their own plantations in conformity with the area and adaptability of each respective holding, such plantations to be amenable to forest laws, under the supreme surveillance of the State.

It may be argued that a man should have the privilege of doing what he pleases with his own land, and that such a law as I advocate would be too great an interference with the rights and privileges of free men in a free country. Such an argument may be all very well in individual interests, but will certainly not stand for a moment from a national point of view. A law compelling us to plant a few gum-trees and cedar-trees on our land would be no more arbitrary than our existing law which binds us to eradicate certain noxious weeds.

The planting of trees and shrubs may well be considered one of the most interesting and important of rural industries, and one which is becoming a subject of great national importance.

Forests exercise great influence on the climate and on the health an death-rate of a country.

The planter obeys the dictates of reason, and justly provides for hi descendants. He improves the value of his estate, and in the performance o his duty he enjoys an innocent and healthy recreation. These consideration apply with equal force to the Government, and present a problem easy o solution. Let us then try to realise the grave importance of the case: th increased value that might be given to unalienated lands, private estate roadsides, streets, &c., by the planting of the most suitable kinds of tree How glorious would be the result of united and well-directed efforts, mor especially on the dry plains of the interior, where in the summer time th weary traveller welcomes a solitary gum-tree as an oasis in the deser Even on the smallest farms a few forest trees and shrubs in the hedges an corners of the paddocks would impart a dignity to the spot. A hous however beautifully built, standing alone without a sheltering tree, is cheerless object of a landscape; even a bark hut, surrounded by a fe ornamental trees and shrubs, is by comparison an interesting spectacle, an far more pleasing to the eye.

Visitors to Tasmania could not fail to notice the pretty hedges th surround so many of the beautiful homes in that island colony.

Notwithstanding the present abundant supply of timber in the Nort Coast Districts and the public cry for the cancellation of reserves, our fore reserves should not be curtailed, except with the object of taking in oth forest land of lesser value for agriculture or for grazing purposes.

We must bear in mind that our forests, although extensive, are rapidl decreasing, and that no natural growth can possibly keep pace with th increasing demand. Even our fastest-growing gum-tree, under the mo favourable conditions of soil and climate, will take from 40 to 50 years mature. The timber is also rapidly decreasing on private lands, and wi such decrease we may reasonably look for a corresponding increase revenue from our forest reserves. This is clearly pointed out by our la Director-General of Forests in his annual "Progress Report" for the ye 1891.

Hence we observe the necessity for wise legislation, and the exercise great care with respect to cancellations of reserves to satisfy claims o behalf of settlement. No wise Government would wish to see our fores destroyed at the expense of the next generation.

Forest Laws

were made in England in the 16th century and in the 17th century th great demand for British oak gave a new impulse to forestry. In Germar we learn that the forests are most systematically managed, and there a about 34,350,000 acres under forest in that country, and it is worthy of no that the best cultivated forests of Germany are worth from three to fi times as much as the native forests, and such will doubtless prove to be th case in this country when the time comes for a more advanced system maintenance and thinning out, &c.

In France since 1848 the area of forest land has been increased by abou 7,000,000 of acres, and 9,000,000 of waste lands have been planted, and previously stated they have (in Algeria) 12,700,000 of our Australian gun trees planted on an area of 130,000 acres. Ireland and Scotland also hav their plantations of from 3,000,000 of trees up to 60,000,000 on priva estates.

I hope the time is not far distant when arboriculture shall be introduced into our public schools, each school having its arboretum and local collection of useful plants. A few hours in each week might advantageously be set apart for the instruction of such pupils as might possess a taste for botany and arboriculture. Such an institution might not only prove very interesting and valuable to the children by educating them into the various uses of plants and their culture, but at the same time it would materially assist in the great national work of reproduction and maintenance of the most useful trees and shrubs indigenous to each respective district.

Brush Forests and Brush Timbers.

Our North Coast forests are interspersed with patches and belts of brush-woods in endless variety. In many places so dense is the evergreen foliage of trees, ferns, orchids, vines, and climbers, as to form impenetrable jungles difficult of access even with the use of the knife or brushhook. From such forests large quantities of red cedar (*Cedrela Toona*) have been removed, but little now remains in a natural state except that which stands in very rough and practically inaccessible places. Beyond those varieties commonly used such as cedar, white beech, rosewood, and a few others, our knowledge is very limited. In the Macleay District alone there are upwards of 100 species which will bear favourable comparison with the best woods of the world for general, cabinet fancy work, and coachbuilding, &c. I may here mention a few of those that were tested for the Indian and Colonial Exhibition of 1887, and found to be adapted for these purposes:—Red cedar (*Cedrela Toona*), rosewood (*Dysoxylon Fraserianum*), white beech (*Gmelina Leichhardtii*), red ash (*Alphitonia excelsa*), brush bloodwood (*Baloghia lucida*) maiden's blush (*Echinocarpus australis*), yellow cedar (*Rhus rhodanthema*), coachwood (*Ceratopetalum apetalum*), corkwood (*Weinmannia paniculata, Weinmannia rubifolia, and Endiandra sieberi*), &c., &c.

I may, however, observe that our rosewood contains qualities of special value for interior fittings, *i.e.*, its extraordinary lack of inflammability, its fragrance, and its resistance to the attacks of all insects; it also possesses a wonderful power of resisting decay even underground, and I believe there are large quantities of this timber lying buried on the banks of the Macleay River, as the first settlers, when clearing the land, found the rosewood so difficult to burn that it became much easier to dig pits into which hundreds of logs of this beautiful timber were rolled and buried.

The Negrohead or Mountain Beech (*Fagus Moorei*) may be mentioned as one worthy of notice, being a tree of large dimensions closely allied to the English Beech. It inhabits the table-land and high mountain brushes. The timber combines density and beauty of grain, hardness, and durability, and favours volcanic soil. It was reported by me some years ago to exist in large quantities on the county boundary of Dudley and Clark and also on the western slopes of Mount Kippara in the Macleay District.

The Blue Beech (*Schizomeria ovata*) also a valuable timber tree of large dimensions, inhabits the Macleay and Bellinger Districts in patches, also favouring volcanic soil, and this tree, like white maple, brush bloodwood, native laurel, and many other useful indigenous timber trees of prospective value appears to be generally unknown even to the most experienced bush-man. The Fig-tree (*Ficus*) of which we have about six varieties in the Macleay District, appears to be a tree of prospective value for its timber. I have known it to have been used for bullock yokes, which proved to be of excellent quality, and the shield of the aboriginal warrior, is a good specimen

of the value of our native fig, combining that tenacity of fibre necessary an capable of resisting the force of the enemy's boomerang, nulla nulla, or eve the spear without splitting. This tree may therefore be regarded as one o considerable prospective value.

In the texture of our timbers there is sometimes such a close resemblanc as to render it practically impossible even for experts to distinguish on species from that of another when sawn or wrought, more particularl is this the case with the stringy bark varieties. Local names are very mi leading and contradictory, hence the necessity for an acquaintance with th botanical characteristics of the woods, combined with a general practic knowledge which would lead to a ready identification of the trees as the stand in the forest.

Waste and Reproduction of Red Cedar.

The wholesale monopoly and waste of red cedar which has prevailed i the North Coast Districts since early settlement is to be deplored, and th consequent loss to the State is irreparable, although under our existing an better organised forest laws the work of reproduction has commenced, an although somewhat under difficulties in these days of financial trouble an retrenchment, may it be continued and extended far and wide. May ou statesmen and legislators faithfully consider that remaining portion of legacy which bountiful Nature in its valuable woods has entrusted to ou care. The maintenance of those woods and the reproduction of our be timber trees should engage their most serious consideration and scrupulou vigilance.

Although life is unfortunately too short for many of us to witness an enjoy the ultimate results, we are not, I hope, narrow-minded enough t oppose tree-planting on this account. An impression does, unfortunatel prevail that our forests have to suit no other purpose than that of supplyin wood for our immediate wants; and even after the warning of climati changes, and scarcity of timber in many parts of the world, no regularl organised forest laws have existed in Australia until very recently, henc the great reduction and in some districts almost total annihilation of th forests. As a generally useful cabinet wood for economical purposes appears that our red cedar (*Cedrela Toona*) is equal, if not superior, t any other in the colonies, and in consideration of its rapid growth an colossal dimensions we could not introduce a plant eligible to take th place of this noble tree in our plantations or native forests.

In the mountain brush portions of our North Coast Districts (the hom of the red cedar) millions of plants might be raised, and I have endeavoure to show approximately by a careful compilation of the following figures th capital invested in this way would ultimately prove remunerative to th State.

Our North Coast reserves contain all the elements necessary for th successful culture of the most useful indigenous timber trees, and with ou variable soils, altitude, and temperature, we might also successfully rais exotic timbers for such special purposes as buggy naves, &c., &c.

Our native forests, already abundant in the best hardwoods in every stag of growth, from small saplings up to trees of gigantic dimensions of 250 fee with a girth of 20 feet, could, of course, be much improved, and th spontaneous reproduction materially accelerated by a judicious thinnin out of all inferior trees, brush and deadwood, while at the same time th

planting of cedar could be carried on from year to year on the most suitable portions and intervening spaces rendered vacant by the clearing and burning off of such useless material, and under such conditions our forest reserves, within easy access of water carriage, are capable of yielding a larger revenue than could otherwise be derived from the land by alienation.

Where patches of dense brushwood exist I would recommend clearing and burning off, after which the land should be ploughed, or roughly chipped in places where the plough may not be practicable, and thus prepared for planting.

The planting season should commence in June, and end not later than the 31st August; the plants which could be produced in millions from our nurseries, may be set out in rows at distances of about 21 feet apart, or say 100 plants per acre, probably this number would not find sufficient space for full development and maturity, although I believe it is better to plant thickly in the first instance as the plants would shelter each other and grow better; by this method we allow a margin for losses of unhealthy plants, and such as might otherwise be destroyed.

In order to allow a very wide margin for losses, and for plants of slow growth, I will reckon that only 15 of these trees would within a period of 50 years attain sufficient size and maturity to become fit for market. Assuming that these 15 trees would then yield 1,500 superficial feet of timber per tree, we would have 22,500 feet of cedar per acre ready for market, which, on the easily accessible portions of our reserves to navigable waters, should be worth 10s. per 100ft. on the ground, equal to £112 10s. per acre. The remaining unmatured cedar-trees in various stages of growth (the prospective value of which should by this time have attained an equal value) may also be reasonably included in our assets against the capital involved.

We have also to reckon our tens of thousands of young hardwood Eucalyptus (tall straight saplings), in many places growing so dense as to have made an almost impenetrable forest, and we may fairly assume that a moderate proportion of these young trees, or the assisted natural growth of such as would be saved after a judicious thinning out would, at the expiration of 50 years, yield millions of feet of valuable timber.

Within the period abovenamed, and under the favourable conditions recommended, these young trees would mature in periodical rotation, *i.e.*, those of the earliest stage (comprising about one-third) within from 10 to 15 years, and the remaining two-thirds in corresponding periods according to their present stages of growth.

In view of our increasing demands, and the constant annihilation of the native forests, it is reasonable to anticipate a corresponding increase in the market value of our colonial timbers; the moderate computation of 1s. per 100 superficial feet, or 12s. per tree, would therefore appear to be the minimum of a proportionate prospective value of the estimated 360,000,000 feet, worth £180,000.

Probably such an enterprise may meet with disfavour in the eyes of our legislators, involving, as it does, private enterprise without guaranteeing a direct profit in the shape of license-fees and royalty. In this case, however, the words private and public may be regarded as synonymous, and it is only by the fostering and development of our native industries, and our great natural resources, that we may anticipate future prosperity. Doubtless our unalienated forests belong to the State, and consequently the value of the timber may fairly be regarded as an asset against the capital proposed to be involved in improvements and general maintenance.

Cedar Planting.

With a view to demonstrate the success which would attend the propogation of red cedar in the Macleay District under favourable conditions, the following practical observations may be of interest.

In the years 1886 and 1887, under the instructions of the Forest Department, I planted a considerable number of young cedars on the Nulla Nulla Creek forest reserves, county of Dudley, parish of Nulla Nulla. These plants were seedlings of natural growth, simply pulled up by the roots from the bed of the creek where they had grown in groups from seed cast by old trees in the vicinity. Many of these plants may now be seen to have attained a height of 15 feet with a diameter of 5 inches. On the old Whitfield Farm, in the vicinity of Kempsey, there stand two fine cedar-trees worthy of notice as relics of antiquity; they stand alone in an open maize-field. Mr. E. Rudder, and other gentlemen, pioneers of the district, remember them well forty years ago when they were very small trees about 7 or 8 feet high. From careful measurements taken by me in October last (1893), I find that these plants have now attained the following dimensions, (*i.e.*) one measures 11 feet 6 inches girth at 4 feet from the ground and the other is 11 feet 7 inches girth at 5 feet from the ground; the height of these trees is only about 60 feet, and therefore out of proportion to the girth of stem, having evidently been stunted in their growth by too much exposure, damages by cattle, and other causes to which young trees must be liable in open pasture or farm land. Certainly the soil is rich deep alluvial, most suitable for the development of cedar, but had other conditions been equally favourable, we may fairly assume that the trees referred to would have attained greater dimensions in height and superficial contents.

Thinning-out.

Doubtless the most practicable and economical scheme of forest conservation with respect to our hardwoods would be to confine our operations to a judicious thinning-out of the abundant spontaneous growth of seedlings and saplings, and a clearing off of useless timber and deadwood upon such reserves as may be permanently dedicated to forestry purposes.

Blackbutt.

I may here direct special attention to our blackbutt (*E. pilularis*), which, in many places, forms the main bulk of our N. coast forests. It appears to be the fastest growing of our eucalypti, and one of our largest and most useful timber trees. The abundant spontaneous growth of this timber requires only maintenance and thinning-out to be rapidly developed into magnificent forests at a comparatively small expense.

Bush Fires.

The prevalence of bush fires may be set up as an argument against the success of forestry; but bush fires are partial in the north coast districts and never very destructive. Owing to the excessive moisture and consequent dense evergreen vegetation that prevails, no material damage is done to the standing timber by fire, except in places where there are large quantities of debris in the shape of felled timber (old logs, heads of trees, &c.)

In a properly thinned-out and well kept forest such debris would be burned off, and not allowed to accumulate on the ground.

It appears to me that, even in the blackbutt (*E. pilularis*) alone, we have abundant material for the development of a wise and economical system of forestry.

Hardwoods belonging to the Myrtaceæ.

The great order of myrtaceæ appears to form the most famous part of our Australian woods, and consists of about 780 species known to exist in the colonies. Of this order the genus Eucalyptus comprises about 140 species; and may be classed first, as I believe it forms the most valuable portion of our forest vegetation, and may be found in various forms and places, from the alpine heights to the tropical and arid regions of the Australian colonies.

The name Eucalyptus is derived from two Greek words, signifying "I conceal well," the cup for a long time concealing the stamens. Eucalyptus globulus was introduced into Algeria in the year 1856, and is now planted by hundreds of thousands in that country, and in many other parts of the world. No less than 12,700,000 gum trees have been planted on an area of 130,000 acres in Algeria.

In California, also, a great quantity of waste land has been planted with blue gum trees. The blue gum (*E. globulus*) and mountain ash (*E. amygdalina*) are known to attain a height of over 300 feet with a diameter of about 20 feet, and are said to be unrivalled in colossal dimensions by any other trees in the world excepting only that of the *Sequoia gigantea*, "The Big Tree of California."

The tallest of our eucalypti is undoubtedly the *E. amygdalina*, which inhabits the Snowy Mountains near the Victorian border and the Cape Otway ranges in Victoria. This tree also yields a large percentage of volatile oil.

It appears from tests of strength made between blue gum, English oak, and Indian teak, that the former is superior, having carried more weight to the square inch than either the oak or the teak.

Myrtaceous trees belong to our Australian colonies, and do not prevail in any other part of the world. In Europe this particular family is only represented by the pretty bush used for bridal wreaths, the myrtle of the ancients.

The jarrah (*E. marginata*) is also a superior timber for ship-building purposes; but, as a valuable timber tree, combining malaria-destroying exhalations which our eucalypti generally possess, the blue gum appears to take the palm. We learn that the best whale ships that furrowed the Southern seas were built at Hobart, and that the keels of those ships were made of blue gum. Each species of eucalyptus contains the well-known oil in greater or lesser proportions, and out of about twenty-six which inhabit the Macleay district, I will mention fourteen or fifteen commonly known as our best hardwoods, *i.e.*:—

Red mahogany (*E. risinifera*).
Swamp mahogany (*E. robusta*).
White mahogany, stringy-bark (*E. armensoides*).
White ironbark (*E. panicutata*).
Red ironbark (*E. siderophloia*).
Grey gum (*E. tereticorius* and *E. saligua*).
Blue gum (*E. saligua*).
Bloodwood (*E. eximia* and *E. corymbosa*).
Tallowwood (*E. microcorys*).
Brush box (*Tristania conferta*).
Stringy bark (*E. eugenoides*).
Blackbutt (*E. pilularis*).

We might also include turpentine, prickly-leaved tea tree, water gum, and others on our list of valuable hardwoods, but these do not belong to the eucalypti, although they belong to the same natural order.

Our colonial timbers are appreciated by the English navy, and it is proved that for purposes requiring great strength and durability they are unequalled.*

The characteristics of our hardwoods are generally so well known that I need not enter upon their respective qualities. I may state, however, from my own personal observations that I have known bloodwood, red mahogany, and grey gum to last underground and retain perfect soundness at heart for forty years, and I have no hesitation in adding that these timbers from matured trees would, under favourable conditions, last for 100 years; but it must be remembered that the qualities of our timber trees vary considerably with the soil and situation in which they grow.

Among other valuable properties possessed by our hardwood timbers for such purposes as jetties, bridges, &c., are their lack of inflammability. An erroneous impression appears to prevail in some departments that no other timber than ironbark is suitable for girders and railway sleepers, whereas we have timbers in our gums, bloodwoods, tallowoods, and mahoganies (although not equal to ironbark in transverse strength) that are well adapted for these purposes, and more capable of resisting decay and the ravages of white ants. We must admit, however, that ironbark is, for many purposes, one of the most useful of all hardwoods, and taking into consideration that it is a tree of very slow growth some restrictions are necessary in order to alleviate the present wholesale waste of this valuable timber which is rapidly disappearing from our native forests. It must be admitted that in the squaring of girders the best of the timber is cut away; for instance, a sapling is much stronger, more elastic and durable if simply denuded of the bark and left in the round.

The strongest poles that I have ever seen in bullock drays were made of ironbark and box saplings, roughly prepared in the round without interfering with the sapwood, and it unquestionably follows that our ironbark girders would be much better if not squared.

The white ant always attacks the inferior parts of the timber, and in the case of ironbark it will invariably be observed that the hardwood is attacked and not the sapwood.

Girders of ironbark should therefore not be squared except on the upper surface, or in such places as may prove absolutely necessary in order to complete the fittings of the culverts or other purposes for which they are used.

Our spotted gum, *E. maculata*, so common on the poorest soils and stony ridges of the Macleay River and other districts, is not only a timber suited to the abovenamed purpose, being strong, elastic, and durable, but it is also a good timber for coach-building, and for stavewood.

It is true that the young timber of this tree will not stand, especially the saplings, which I have known to have been destroyed by white ants within twelve months; hence from lack of discrimination between the matured and unmatured timber of this species, spotted gum is often very unjustly condemned, and not generally appreciated.

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* For street-paving blocks and railway sleepers and taking into consideration the superiority of our colonial hardwoods for such purposes, the great demands of Canada and the United States might readily be supplied by New South Wales at comparatively more economical rates than they are being supplied by the local markets. Our best hardwoods for such purposes will last for 20 or 30 years, while the American timber will not last more than from 4 to 7 or 8 years.

Sawn and Hewn Sleepers.

The prohibition of sawn sleepers for railway purposes is also erroneous. The best timber for combined strength and durability is that which will not split, *i.e.*, such as may always be found in very large quantities lying waste in remnants of trees that have been left by splitters in the forest; and on the same principle, if we require a good maul or mallet wood we should make our selection from the cross-grained limbs of a big tree; from such limbs in the heads of our ironbarks, tallowwoods, and box trees we might also find timber most suitable for block sheaves and other purposes requiring the greatest strength and tenacity of fibre. Indeed it appears that our colonial timbers are eminently adapted for almost all the uses to which timber is applied, and while strongly advocating the introduction of foreign trees such as may be found most useful and suited to our soils and climate, our own native trees appear to be generally of more importance.

Timber in the United States.

The demand for timber is said to be increasing in the United States at the rate of 25 per cent. per annum, and the decrease of the native forests must be proportionately exhaustive. The out-put from America annually is something like 18,000,000 of feet, and it is estimated that about 37 per cent. of the total comes to Australia—this is to be deplored, seeing that we have much more durable timber in the colonies going to waste—and at the present rate of destruction of the forests in America, particularly in the States of Wisconsin and Michigan, it is estimated that there will be no timber left standing in those States 50 years hence, and that it will take 100 years under the most favourable conditions of propogation to replace the virgin forests.

There are in existence establishments manufacturing articles of wood alone nearly 120,000, employing nearly 8,000,000 persons, and using wood valued at about $550,000,000 annually. During the Civil War in North America 28,000 walnut trees were cut down to supply one single factory with the material for gun-stocks, and this valuable timber so highly prized for cabinet work is nearly exhausted.

Special Woods.

Although it is generally admitted that we are deficient in woods suitable for buggy naves, &c., I am of opinion that our forests contain abundant material suitable for such purpose, as a better experience in the art of seasoning timber will ultimately prove. The question, however, of raising exotic timbers for such special purposes may be regarded as an important one.

The Forest Department is already in possession of some samples of South Australian grown American ash turned for wheel naves, which are supposed to be quite equal to the American grown timber.

In the course of my travels in January and February last, I observed that the State Nursery at Campbelltown had produced many thousands of well grown American ash (*Fraximus americana*) ready for distribution, and that they appear to do well, although we have yet to learn whether the climate of New South Wales is suited for the successful development of this valuable timber, and I would recommend a trial in our sub-alpine regions.

Ringbarking.

That pernicious system of indiscriminate ringbarking practiced throughou the country cannot be too loudly censured. Although we know that th grazing capacity of forest land has been greatly improved and increased b ringbarking, the same good results might be obtained by a more judiciou system of thinning out or leaving belts and groups of timber of prospectiv value, thereby adding much to the value as well as to the beauty of the land. I also appears that excessive ringbarking materially decreases the drough resisting capacity of land. Some of the best country that I have seen to with stand the effects of drought and carry stock in all seasons is undulatin country interspersed with belts and groups of timber.

There are parts of the world where the operation of causes set in actio by man in the destruction of the forests, have brought the once fair face o the earth to a desolation almost as complete as that of the moon, althoug they were previously known to have been covered with luxuriant woods, an man's improvidence in this respect caused sad conditions of unproductiv ness and climatic excess. Even my own limited experience satisfies m beyond doubt that the absence or destruction of the forests involves period floods and droughts, and I have known squatters in the treeless plains o the interior to lose their flocks and herds, and even the kangaroo to peris by thousands for want of grass and water. How hopefully have we watche every promising cloud that appeared on the horizon only to dissolve rainle in desert air, and when the ruin was complete, and the last waterhole drie up, great atmospheric changes would set in, and the dry creeks would b converted into foaming torrents, inundating with furious floods the lan over which the carcases of the famished cattle and sheep were strewn abou such disastrous scenes are not uncommon in the dry thinly wooded plai of the interior.

Let us then take timely warning, and consider the teachings of scienc that denuded earth parts with its warmth by radiation, and is intense heated by insulation, and that thus in woodless countries we find th extremes of heat and cold, the winter being far more intense and boisterou and the summer heat far more burning and oppressive.

The landscape of Great Britain has undergone a complete change; muc of her waste and barren land is now covered with plantations, and we lea that the adjoining lands have consequently become more fertile, and th food production greatly increased.

Seasoning of Timbers.

As a general rule our colonial timbers are not fairly tested, being c down and used up at any time as they may be required, irrespective maturity or season of felling.

If the trees were cut down at the fall of the leaf when the sap is partial suspended, and then seasoned under the ordinary orthodox method o seasoning timber under proper shelter, that sudden transition of the sa and consequent contraction, thereby rending the timber and otherwi decreasing its strength and durability would, in a great measure, be avoide This theory, however, applies more particularly to deciduous trees which we have very few, and is certainly not practicable with regard to th non-deciduous or evergreen varieties which form the main bulk of ou Australian forests; many of our timber trees are so free in the grain an so full of sap at all seasons that we have yet to learn how that destructiv contraction may best be prevented.

I have found, where practicable, that in the case of very small logs an auger hole bored longitudinally through the heart has the desired effect. The ventilation thus made causes a more even process of drying and shrinkage, but I am of opinion that the best method of seasoning timber is by denuding the tree of a portion of its bark, say, a good ring of 12 inches wide or more from the full circumference of the trees intended for sawing, at least three or six months prior to their being felled for the mill.

A tree thus ringbarked dies slowly, and in its upright position is rapidly drained of its sap through the natural channels, but when the tree is felled green, and the logs allowed to lie on the ground, the sap and acids percolate into the wood tissues and remain there, gradually decomposing and rotting the timber. The advantage of this system is obvious, and I have learned from practical experience that the best quality of timber is obtained from trees that have been stripped of their bark, and allowed to die and season in a perpendicular position.

Planting to minimise disastrous effects of Floods.

The recent flood devastations on the northern rivers are readily traceable to the improvidence of the early settlers in their indiscriminate destruction of the timber and undergrowth along the river banks, which in former years checked the force of the flood waters, supported the banks, held the silt, and slowly, but surely raising the level of submerged country.

Since the river banks have been denuded of their natural protection there has been a gradual erosion as well as a silting up of the river beds. Even now it is not too late to remedy much of the evil done by planting trees, shrubs, and grasses with long descending roots, and of the most suitable kinds for holding embankments, and as it is desirable that such plants should be of a utilitarian character, I here submit a list:—Basket willows, bamboos, wattles (*Acacia decurrens*, *A. mallisimo*, *A. dealbata*, and *A. leiophylla*). The last-named is the most suitable of the acacias, as from its roots, which extend a long distance, numerous suckers are thrown up, forming a dense thicket, which would require a great power to uproot. *Panicum spectabile* (the Coapim of Angola) rapidly sends out a network of runners, covering the ground to a great distance, while at the starting-point it forms a mass of the richest green foliage, over 6 feet high, and could thus be utilised for green fodder or made into ensilage for cattle. New Zealaud flax, Marram grass, Japan clover, Indian couch, buffalo, and lucerne are also recommended. Roots of the *Arundo Donax* (bamboo end of Southern Europe) are recommended for the margin of streams, and these roots can be obtained in any quantity.

Doubtless a sloping-off of the banks would be necessary in places at the time of planting, and the plants would require to be protected by a line of fence, but when once fairly rooted they would soon form a complete network of binding to prevent further erosion of the banks.

Such belts along the river banks, assisted by the intersection of wide hedges, planted at right angles to the river, along the boundaries of the farms, would very soon (under careful maintenance) form impenetrable thickets, sufficiently honeycombed and strong to bind the soil below the surface, while above ground they would prove sufficient to stem the force of the current and hold the silt brought down by flood-waters. Doubtless flood-cuttings are also desirable, if they can be carried out, more particularly on the Macleay River and in the vicinity of Kempsey, to alleviate the terrific force and volume of water round the great Horseshoe Bend and through the

town, but such cuttings, to be successful, must be worked in conjunction with the proposed planting, and under such conditions even the present owners may live to see their devastated fields converted into smiling pastures, and their homesteads and gardens no longer subject to the destructive influences of flood-waters.

There is no doubt that our alluvial deposits have generally been formed with the growth and by the aid of the timber and brushwood which clothed the river banks at the period of early settlement, and unless this natural protection is in some adequate measure artificially restored, so will those alluvial deposits in many places slowly but surely be carried away again. Landowners should profit by the lesson nature thus clearly reveals; united action, if such a thing be possible, and a few shillings per acre on each respective holding having a frontage to the Macleay River, and otherwise affected, would make that district become one of the richest in New South Wales.

Notes on the Diseases of Plants.

By N. A. COBB.

Diseases of the Bean-plant.

I. Bean Anthracnose (*Colletotrichum Lindemuthianum.*)

"As ye sow, so shall ye reap."—Old saying.

The anthracnose of the bean plant is the disease often called bean-rust; this is a mistake, however, as the real bean-rust is quite different, and much less troublesome. The two diseases are mistaken for each other because each is characterised by the presence of brownish or rust-coloured spots. There is really little difficulty in telling the two diseases apart, if we remember that the anthracnose produces large sunken spots on the pods, while the true rust, if it attacks the pods at all (which is not often) produces elevated, rather than sunken spots.

Bean anthracnose occurs, it is safe to say, wherever beans are grown extensively. I have observed it to be abundant in various parts of North America, Europe, and Australia, and have received specimens from other parts of the world. It is so excessively common that I believe it would be a matter of difficulty to secure a shipment of seed-beans not containing it; and from this fact it will be easily inferred that each new settlement has in turn, from time immemorial, received along with its bean-seed, this disease. Should the bean be in future introduced into new settlements, as, for instance, into Western Australia or Central Africa, it is possible that, by using care in selecting seed, the disease might for some time be excluded.

The disease is not confined to any particular variety of beans; it attacks all the numerous varieties, pole as well as bush, which belong to the species *Phaseolus vulgaris, L.* It is more fatal, however, to the early sorts and to those used for cooking, pods and all, before they are ripe. The various so-called wax-beans and butter-beans are particularly subject to injury, the very quality which makes these sorts most valuable, namely, tenderness, being also that which renders them most subject to the disease.

No part of the plant is free from attack; root, stalk, leaf and pod are alike subject to attack;—but the pod is the locality where the disease is most conspicuous, and likewise the place where the greatest damage is done. The damage may be regarded as of two sorts—

1. Damage caused by preventing the growth of the pod.
2. Damage caused by injury to the seed.

1. The damage caused by preventing the growth of the pod is easily seen, and easily understood. If the pods do not grow, there is no crop. If they are misshapen and small, the crop is a partial failure. Both these causes are of frequent occurrence.

2. The damage caused by injury to the seed, is not so easy to see, nor so e
to understand; yet it is precisely on this point that I wish to lay grea

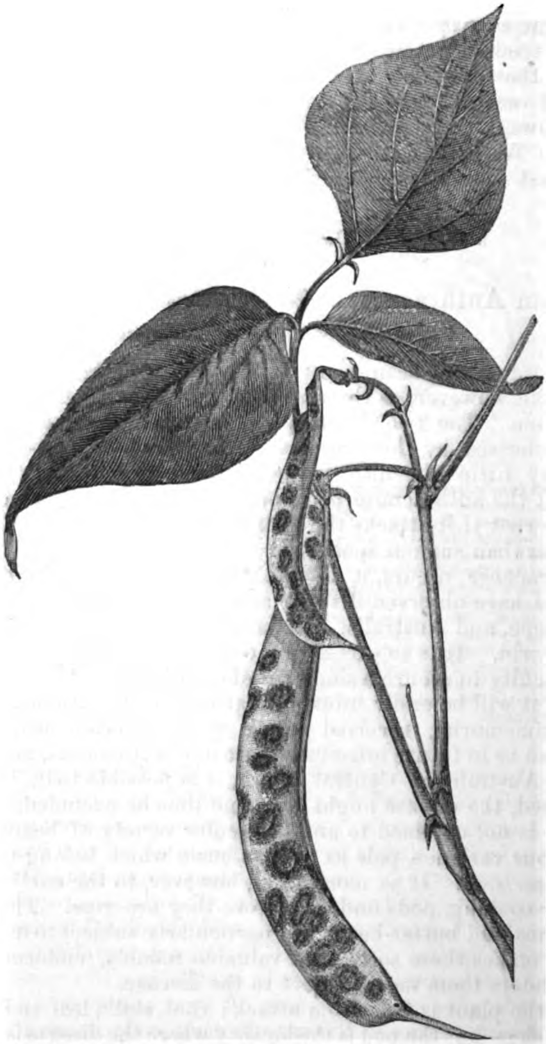


Fig. 1.—Bean pods attacked by bean anthracnose. The disease has covered the pods with sunke dark brown pods. One of the pods has failed to grow to full size, and will produce worthle seeds or none. The way in which the disease affects the beans inside the pods is shown i Fig. 2.

stress, as upon it is based the most important measure to be taken in c
batting the disease. A thorough understanding of the whole matter ma
it necessary to notice the cause of the disease, which is the fungus wh

scientific name is given at the head of this section, and figures of which are here inserted. This fungus grows inside the tissues of the bean pod, and its effects are seen in the death of the tissue of the pod, and its collapse, which gives rise to the brown sunken spots which are so conspicuous. The fungus extends so deep into the tissues, that it attacks the seeds inside the pod. If this occurs on comparatively well-grown pods, the size and appearance of the diseased seeds is not greatly different from healthy seed. Yet mark the difference if these diseased seeds be sown. The new seedling comes up diseased, and very often dies before it can produce its first three leaves. As everyone knows, the two halves, or cotyledons of the seed "come up" with young plant. When these cotyledons are diseased, that is to say contain the fungus as just described, they soon communicate the trouble to the tender

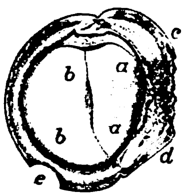


Fig. 2.—A slice cut from a bean pod, and so taken as to cut through a bean and also through diseased spots caused by anthracnose. The bean is of the sort known as the black bean, so that the outline of the seed shows as a wide black line; *aa* is one half of the seed, and *bb* is the other half. That part of the figure outside the wide black line represents the pod. Two diseased spots are shown, one at *e* and the other extending from *c* to *d*. The disease has extended from *cd* through the pod and *into the seed itself* as far as *aa*. This occurred while the bean was growing, and hindered the growth of the seed, which, in consequence, appears in the figure as somewhat one-sided. The spot *e* became diseased later on, and has not yet affected the seed.

Fig. 3.—A spore of the fungus which causes the anthracnose of the bean-plant. The spore has germinated and produced a short sprout, on the end of which another or secondary spore of smaller size and darker color has grown. These spores of the bean anthracnose are colorless, ellipsoidal, and are borne tandem on a minute stroma, of which a number generally grow together in the older sunken part of a diseased spot. They measure about $8\mu \times 17\mu$.

young plant that has sprung from them. The fungus runs riot in the succulent and tender tissues of the plantlet, which, in consequence, soon dies, or if not, at least suffers severely. Any bean-grower can demonstrate these facts to his own satisfaction, simply by sowing beans taken from badly-spotted pods, and watching the results. As soon as the young plants have produced two leaves, or even sooner, the trouble begins. The disease creeps from the cotyledons (the two half beans that come up with the plant) to the stalk and to the stems of the first leaves. Sometimes the leaves drop down, so weak do their stems become. Occasionally the stalk itself is in a like manner, so weakened that the plant topples over as if eaten off by a cut-worm. In fact I have known this disease acting in this way to completely deceive the grower, and cause him to attribute the whole trouble to cut-worms. The number of seedlings killed in this manner is various, but seldom exceeds fifty per cent. It is very often from ten to thirty per cent., thus giving rise to a very poor stand, and necessitating a great amount of tedious and expensive replanting, a loss which has to be subtracted from the margin of profit.

It will be very profitable to study a little further into the nature of this disease, for there are one or two further precautions that can be taken with advantage, and the reason for them will be made plain if the leading facts

in the progress of the disease are once clearly understood. If one of the older sunken spots on the pod be examined attentively, all the better if with a magnifying glass, a number of whitish or salmon-coloured points will be seen in the midst of the dark coloured area at the centre. These light coloured points occur when the fungus, having come to a head (formed a stroma), has begun to produce spores. The spores are very minute, and the tiny points on the sunken spot, small as they are, contain thousands of spores cemented together by a substance which is soluble in rain-water or dew. Each spore corresponds to a seed, and is capable under favourable conditions of making another diseased spot like that from which it came. When we consider that these spores are so small that we might easily pick up a hundred thousand of them on the point of a hair,—so small that hundreds of them would easily cling to a fly's foot without troubling him,—so small that the slightest gust of wind might lift them several feet from the ground, and so light that they will of themselves almost float in the air, then we can easily understand how it is that many acres of beans afflicted with this disease are such a common sight.

The spores germinate only in the presence of moisture. On a rainy day or a dewy eve they are dissolved from their birthplace and floated or spattered to new places on the same plant or on other plants. There they sprout, enter and grow, until another diseased spot has been produced, and then spores are again formed, and the whole process repeated. In favourable weather this process occupies about a week,—sometimes less. There is a saying among gardeners that beans should not be cultivated or disturbed while the dew is on them or when wet, because it spreads the "rust"—by rust meaning anthracnose, the disease we are discussing. This saying, founded in experience, is in exact accordance with the facts as discovered by men of science, and is a good illustration of the way in which practical men, learning by hard experience, have often anticipated the precautions recommended later as the result of scientific research.

As said before the anthracnose is not confined to the pod. When it occurs on the stalk it gives rise to sunken spots like those on the pod, but less defined; the spots are more inclined to run together, especially on young plants. On the leaves the fungus affects particularly the veins, turning them first brown and later on black; at the same time it affects the other parts of the leaf and similarly discolours them, and ultimately it "burns" through the leaf, making a crack with ragged edges.

Remedies.

1. *Selected Seed.*—The best remedy for anthracnose of the bean is care in the selection of the seed. The trouble taken to secure only healthy seed will be amply repaid at harvest time. The time thus spent is very profitably employed. "As ye sow so shall ye reap." He who puts in seed already attacked by anthracnose will reap a crop attacked by anthracnose,—if indeed he reaps one at all. Healthy seed is to be procured from a healthy crop. If such does not grow on the farmer's land he can sometimes procure it from elsewhere. If not, then a selection can be made from a diseased crop as follows. First, examine the crop and harvest from the part of the field least diseased, about twice as much as is needed for seed. This selection from the crop as it stands in the field will often save much work afterwards. Second, after threshing out the beans, reject all that are in any way discoloured or shrivelled. The discoloured and shrivelled spots contain the disease and the inspection must be such as to exclude if possible every bean that is spotted.

I have in some cases hand-picked the seed in the field, gathering only the *healthiest looking pods*, and I can recommend this method when the whole crop is badly diseased. If, when badly diseased, the crop be harvested and threshed as usual, many very bad pods will be threshed out and the sorting of the beans is about four times longer than the sorting of the corresponding pods.

2. *Spraying with Bordeaux Mixture.*—Whether this be profitable or not depends on a variety of circumstances. If the grower already has a spraying machine which is in use on other crops, it will undoubtedly pay him to spray his beans with Bordeaux Mixture if they are attacked by anthracnose. If he must buy a machine and spray for this disease alone, spraying will not pay him unless he is growing several acres of beans and habitually loses at least ten per cent of his crop under ordinary circumstances. If beans growing by the acre are badly attacked, spraying will pay, that is to say the additional crop will be more than sufficient to repay the cost of spraying. The spraying should be begun early. It is of little use to wait until the disease is bad and then commence to spray. As soon as the plants have the first two leaves well grown, they may be sprayed for the first time. They should afterwards be sprayed twice or more according to the weather. If the weather be rainy more spraying is required than if dry. If a rain comes on immediately after spraying, the Bordeaux Mixture is washed off and very little good will be done unless another spraying be done again at once. The object of the spraying is to cover the plants with a substance poisonous to the spores of the disease. This kills many spores that are still attached to the spot where they grew, and furthermore prevents any spores which are not so killed from germinating on the surface of the bean plants. At the first attempt to sprout the spore absorbs some of the poison that has been sprayed, and is killed. No fear of poisoning from the eating of sprayed pods need be entertained if the last spraying was done three or four weeks before cooking. All careful cooks wash the pods before snapping them. The Bordeaux Mixture is made as usual. Prof. Fairchild recommends the addition of enough soap to form a suds. This causes the spray to cover the plants better.

3. *Burning.*—The burning of all diseased vines and other trash is strongly advised. This should be done as soon as the same are of no further use. They should not be allowed to lie on the field, or anywhere where they can infect either the land or the crop. Very few farmers realize the advantage of the destruction by fire of all diseased rubbish immediately after harvest. Of course, burning is not so necessary if the following crop is to be of a different kind.

4. *Change of ground.*—Of course, the ground beneath the diseased beans becomes charged with spores, and is, therefore, a possible source of infection; for this reason the bean crop should be moved to land not recently cropped with beans if this can be conveniently done.

5. *Drainage.*—Good drainage is advisable for many reasons; among others is the fact that moisture is favourable to the growth of the anthracnose fungus.

6. *Choice of varieties.*—There is much difference in the susceptibility of different varieties, but the susceptible varieties are precisely those which are most luscious, and which, therefore, bring the highest market price, at least among snap-beans; there is, therefore, little scope for choice of varieties.

It is useless, or nearly so, to treat the seed with bluestone, hot water, or any other preparation commonly used for pickling seed.

II.—Bean Rust (*Uromyces Phaseoli* [*Pers.*], *Winter*).

Though the appearances produced on the bean-plant by the true rus fungus bear less resemblance to common iron rust than those produc

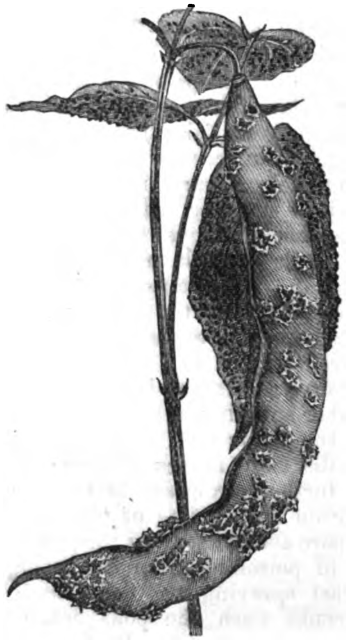


Fig. 4.—Bean-plant attacked by rust, *Uromyces phaseoli (Pers.) Wint.* The leaves and pod are covered with raised dirty-brown diseased spots, round which one sees the torn epidermis of the bean. The brown powder is composed of spores which, when magnified, appear as shown in Fig. 5.

by anthracnose, still it is best, in view of the nature of the fungi caus the two diseases, to apply the term rust to the present disease. Bean r is very common. It is to be found on plants here and there in most cr

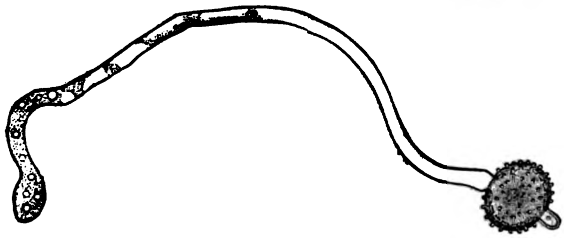


Fig. 5.—A spore of the bean-rust fungus magnified four hundred times; the spore has germinated and produced one long sprout and one very short one. These round or shortly elliptical pale-brown echinulate uredospores, measuring 15-22 x 24-30μ, are borne on pedicels of twice their own length, in brownish sori, which are destitute of paraphysis, measure from one to five millimetres across, and are situated on the leaves, more especially the under side, and less often on the pods and stalks.

of beans. Occasionally, however, it develops into a serious disease t causes considerable loss. The fungus causing the disease occurs on all pa

of the plant, more particularly, however, on the leaves; in severe cases it appears on the pods. The pustules of the fungus have a brownish, powdery appearance, and from them a brown powder can be removed on the finger. The brown spots vary in diameter from mere points up to an eighth of an inch. At first the fungus is under the skin of the leaf or pod; afterwards it breaks through, forcing the ruptured skin to one side, so that the torn edge surrounds the pustule on every side.

Remedies.

The remedies are the same as those just given for anthracnose, though much less stress is laid on the selection of seed as the rust fungus is less likely to attack the pods.

Peach Freckle.

(*Cladosporium carpophilum.*)

This is a disease common on late peaches. It attacks the surface of the peach, and gives rise at first to small, round, dark green spots, which in time grow and run together so as to cover larger areas. Often the whole of

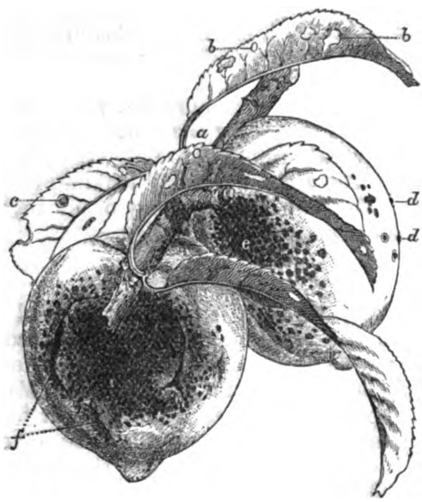


Fig. 6.—Two peaches attacked by the peach-freckle fungus, and also to a slight extent by shot-hole fungus; *a*, *b*, holes produced in the leaves by the shot-hole fungus; *c*, a shot-hole from which the centre has not yet fallen away; *d*, *d*, two scabs produced by the shot-hole fungus,—these are elevated above the surrounding surface of the peach, and are thus easily distinguished from the freckle spots shown at *e*; *f*, cracks due to the action of the freckle fungus.

one side of a peach is attacked. It is common in late stages of the disease for the peach to crack in the midst of the freckled area, and at last it becomes rotten and worthless.

This disease does not ordinarily do much harm, but it sometimes causes wholesale loss among late peaches amounting to over fifty per cent. of the crop. Even if the fruit is not destroyed its flavour and market value are nevertheless injured. Wet seasons are most favourable to the development of this disease, which is well represented in the accompanying woodcut.

Peach freckle must not be confused with peach scab. The scab attac early or late sorts alike, and is always accompanied by leaves filled wi so-called shot holes. These holes are made by the same fungus that caus the scab on the fruit. Though the scab fungus or shot-hole fungus does n

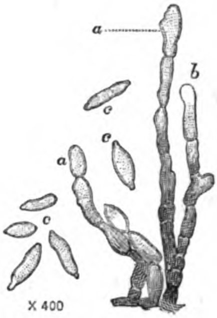


Fig. 7.—The peach-freckle fungus magnified; *a*, *a*, spores; *b*, top of a hypha, where a spore has begun to form; *c*, *c*, *c*, spores that have fallen off. The smooth somewhat olive-green straight or somewhat crooked, ellipsoidal to fusiform apiculate spores, are one-celled, sometimes two-celled, and measure 11-20 x 5 μ; they are borne singly or tandem on irregular branched septate hyphae, so wefted together as to produce greenish "freckles," which, by becoming confluent, cover irregular areas, sometimes upwards of twenty-five millimetres across.

damage peaches so much as it does apricots, yet it sometimes material injures peaches. The scabs caused by the shot-hole fungus are *raised*, whi the spots caused by the freckle-fungus are not. Scabby peaches are roug freckled ones are not. The scabs are rusty looking, while the freckles a dark green or black. The two diseases may occur together on the sa peach. Such a case is shown in the above figure.

Remedies.

Spraying with Bordeaux Mixture is probably a good preventive of th disease. The spores of the freckle-fungus are poisoned and killed by t mixture. I have not yet had an opportunity to spray for the prevention this disease, but would advise the use of Bordeaux Mixture, one-half t usual strength, to be applied at intervals of a fortnight for about two mont previous to ripening; in other words, long after the leaves have become o and hardened. This advice is given because the spring foliage of pea trees is injured or killed by Bordeaux Mixture.

Black Rot of the Tomato.

(*Macrosporium Tomato.*)

This is the worst disease attacking the tomato, and is only too well-know to all who have grown that fruit. Dark spots appear first, usually at th blossom end of the fruit; these slowly enlarge until by the time the fruit ripe it is spoiled—half or nearly the whole of the tomato has turned blac and collapsed. The fungus that causes the trouble is a black, or rather dar green, growth, which gives rise on the surface of the tomato to dark gree velvety-looking "cushions," composed almost entirely of spores. The form these spores is well illustrated on the following page.

Other fungi occur together with the *Macrosporium*, but they are of secondary importance, as they never occur except the *Macrosporium* has first

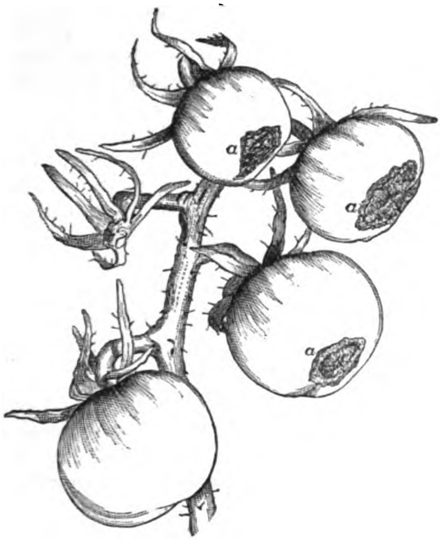


Fig. 8.—Tomatoes attacked by black rot (*Macrosporium tomato*). The rot is seen at *a*, *a*, *a*, spreading from the blossom end. The lowest tomato is not yet attacked.

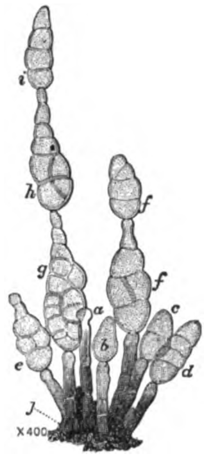


Fig. 9.—Small portion taken from one of the dark green cushions caused by the black-rot fungus of the tomato (*Macrosporium tomato*). *a*, a spore just beginning to form on the top of a hypha; *b*, a spore of one cell, being the result of the growth of such a beginning as is shown in *a*; *c*, a spore that has become two-celled; *d*, a spore that has become four-celled; *e*, a spore that has become many-celled; *f f*, a spore that has become many-celled and produced another spore on its tip; *g h i*, a chain of three spores; *j*, bulbous base of the aerial hyphae. Below *j* is the surface of the tomato. The dark olive-green to brownish spores vary in size from 15 x 9 μ, when one-celled and ovate, to 100 x 20 μ. when many-celled and obclavate. When compound they are divided in a muriform manner in both directions, and are borne singly or tandem on the tips of erect caespitose simple or nearly simple blackish sparingly septate aerial hyphae, which are considerably shorter than the largest of the spores, and have a diameter of 4—5 μ. The spores have a crenate contour and in germinating, each cell of which they are composed may give rise to a hypha.

appeared; they are not known to by themselves cause damage. Of these secondary forms no less than three are common. The spores of these three

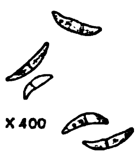


Fig. 10.—Spores of *Fusisporium*, magnified.

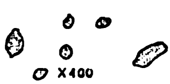


Fig 11.—Spores of *Penicillium glaucum*, magnified.

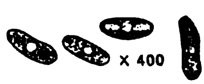


Fig. 12.—Spores of *Glœosporium frutigenum*, magnified.

are here figured. The first causes a whitish or salmon coloured growth on the surface among the dark green cushions of the black-rot fungus, and is a

species of *Fusisporium*. The second is the common ripe-rot fungus, *Glœosporium frutigenum*. The third is the green mould, common on bread and old boots, *Penicillium glaucum*.

Remedies.

1. *The use of trellises.*—The black rot fungus grows best in a damp atmosphere, and near the ground. Hence, if the tomato vines are kept from the ground by a high trellis, or are tied to stakes, they suffer less. Merely trellising the vines will not prevent or stop the rot; it will only hinder it. A further precaution consists in cutting off the tops of the vines. This lets in more sunlight, and does not injure the vines if they are growing thriftily. Both the above measures should be adopted regardless of disease; but we have noticed that tomato-growers frequently neglect them.

2. *Choice of varieties.*—Some varieties of tomato suffer less than others, though there is no variety known that is proof against the disease. The smoother varieties—that is, those having no creases—generally suffer least. These smooth-skinned, nearly spherical sorts are also superior, so there is a double reason for growing them.

3. *Burning diseased fruit and vines.*—Never allow rotten tomatoes to lie about; gather and burn them as soon as they show signs of disease, which is often when they are no larger than peas. This precaution is one that undoubtedly pays. Nothing less than the complete destruction by fire of the diseased material will answer; burial is not recommended.

4. *Drainage.*—The disease is usually worse on undrained land. Good drainage is therefore advisable.

5. *Choice of seed.*—Never use seed from diseased tomatoes, or, if it can be avoided, from vines that have shown the disease.

6. *Change of ground.*—When the disease has been bad on a given piece of ground it is not advisable to plant it again with tomatoes for a season or two. A better crop of tomatoes will be obtained by putting the crop on other ground, if such that is suitable can be had.

7. *Spraying with Bordeaux mixture.*—The beneficial results of spraying tomatoes for black rot are still questionable. Spraying the fruit after it is once attacked is nearly useless. On the other hand, some good appears to result from spraying the young vines, and then periodically once in two or three weeks. Spray in particular the young fruit. I would not, at present, advise a grower to invest in a spraying machine with a view to making greater profits through spraying his tomatoes; but if he already has a spraying machine, or has other crops that it would be profitable to spray, I should, without hesitation, advise spraying the tomatoes as recommended above, if it can be done at the same time as other spraying.

In general, then, it will be seen that the measures recommended to be taken against the black rot of the tomato are such as can be based on what we know about the fungus that causes the rot. Destroy this fungus whereever it can be seen, and be very suspicious of any vine or piece of ground where it has appeared. The spores are small and invisible, are produced by thousands, and are easily spread by the wind, by water, and by cultivation; they have great vitality, and thrive best where it is moist. These facts show why it is best to trellis, trim tops, and drain, as well as the reason for removing to new ground.

Sporobolus indicus, R. Br.

(11659-94)

"Parramatta or Tussock Grass"

A Mango Blight.

(*Pestalozzia uvicola*, Speg.)

ANGOS frequently reach the Sydney market covered, or partly covered, by et black blight, caused by the fungus whose name is given above. The

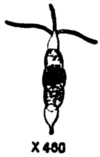


Fig. 13.—Spore of *Pestalozzia uvicola*, Speg. The black globose erumpent pustules, half a millimetre or more across, occur close together, each being surrounded by the torn cuticle of the fruit, and bear five-celled spores measuring 40 x 7 μ., each of the end cells being hyaline, the apical one bearing three colourless cilia, 14 x 1 μ.

ne fungus is not uncommon on grapes. The spores of this fungus are soned by Bordeaux mixture. This fact points toward the Bordeaux xture being a suitable mixture with which to experiment on mango trees acked by this fungus.

Common Disease of Grass, *Sporobolus indicus*.

(*Helminthosporium Ravenelii*, Curt.)

IGHTED specimens of this grass, *Sporobolus indicus*, have often been ferred to me by stock owners with the query: "Is it injurious to stock?" this I can only reply, "Probably not." I have fed large doses of the ngus causing the blight, to fowls without causing any serious symptoms.

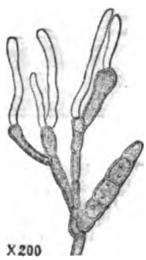


Fig. 14.—Portion of the mycelium of the fungus, *Helminthosporium Ravenellii*, which blights the heads of *Sporobolus indicus*. A single five-celled spore is shown. The dark-coloured irregular nodose septate branched hyphae form spongy masses in place of the fruit of the grass, and bear a large quantity of three- to five-septate brownish spores, measuring 50—90 x 5 μ.; these occur singly on the branches.

porobolus indicus is a harsh, wiry grass avoided by stock so long as anything se decently good is available, and they therefore eat but little of it under dinary circumstances. A figure of the grass is given, as well as of the ngus. The blight is black, and appears only in the heads of the grass. It sembles a smut in appearance.

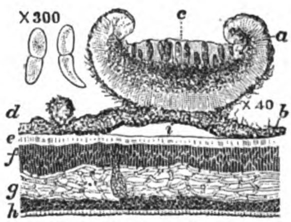
A New Australian Fungus.

BY N. A. COBB.

THE species of *Peziza* here described was found by Mr. J. J. Flet
secretary to the Linnean Society of New South Wales. Its abund
on the leaves of *Lyonsia*, most likely of the species *reticulata*, and its r
striking appearance, led him to collect it and forward it to the author.

Peziza, Dill.

Peziza lyonsiae, n. sp. Cups somewhat gregarious on both sides o
leaf, on ashy grey, roundish, often confluent, spots, 3—10 millimetres ac
flat, sessile, round, varying in diameter up to one millimetre, and ha
incurved margins. The mycelium covers the surface of the leaf with a
ash-coloured layer, which scales off rather easily. From a little distanc



Cross-section through the fruit of the *Peziza lyonsiæ*; *a*, perithecium; *b*, ash coloured myceliu growing on the surface of the leaf of *Lyonsia*; *c*, the eight-spored asci; *d*, a young peritheciur *e*, upper epidermis of leaf of *Lyonsia*; *f*, green palisade tissue; *g*, loose parenchyma, contai ing here one vuscular bundle; *h*, loose epidermis of leaf of *Lyonsia*; *i* shows where t mycelium of the fungus has been pulled away in making the section.

leaves appear as if attacked by a scale insect. The young perithecia
spherical and pilose. The ripe perithecia are brown, and nearly smo
they measure ·5 mm., and have a raised margin. The fusiform or cylind
asci measure about 75 x 40 μ. The smooth, colourless spores are two-ce
sometimes straight, sometimes curved, and measure 25—28 x 8 μ. Paraph
cylindrical filiforum, and colourless.

Habitat.—Parasitic on the leaves of a species of *Lyonsia* (*reticulat*
v. M. ?), New South Wales, accompanying the black fungus so often
on that plant. The *Lyonsia* did not appear to suffer seriously.

Apple Culture.

By ALBERT H. BENSON.

CHAPTER II.

Thinning and Gathering the Fruit.

Where the trees are heavily overladen the fruit should be judiciously thinned, so that the fruit that remains may have a chance to attain a fair size and develop properly, as it will then be more saleable than the undersized fruit from an overladen tree, and the tree itself will not be injured by the weight of the fruit breaking limbs, or, as sometimes happens, by splitting the main trunk, thereby seriously injuring, if not actually destroying, the tree.

In the case of many of the earlier varieties, especially cooking ones, the fruit may be allowed to develop to a sufficient size to be saleable, and then thinned, the balance of the fruit being allowed to come to maturity. In all other cases where the trees are heavily loaded, and unable to properly develop all their fruit, they should be thinned as soon as the crop has properly set, and there is no further chance if any fall taking place. The amount to be thinned will depend on the kind of fruit, the nature of the soil, age of the tree, and the brittleness or toughness of the wood, as different varieties of apples vary very much in this. With large cooking varieties the thinning should be severe so as to produce a large-sized fruit, yet not so severe as to produce oversized fruit, which are usually of little value, being soft and coarse. With desert apples, where a medium sized fruit—that is to say, a fruit not exceeding 3 inches in diameter—is required, it is not necessary to thin so severely, but as many fruit should be left on the tree as the tree is capable of growing to perfection, without breaking down or otherwise injuring the tree. There is another danger from over-cropping that I have omitted to mention, and that is the danger of opening the head of the tree too much by the weight of the fruit spreading and bearing down the branches, thereby exposing the inner parts of the tree to the direct action of the sun, which, striking right on the unprotected bark, is often the cause of sun-burn which is usually the immediate cause of several diseases, notably scald, or, as it is generally called, fire-blight.

Simple as the gathering of the fruit seems, it is nevertheless a very important operation, and one that it will pay the growers to attend to thoroughly, especially where the fruit has to be sent some distance to a market, or where it is intended for export or for storing for our own local markets. Always gather the fruit carefully, bruising it as little as possible, as a bruised fruit is always a blemished fruit which detracts from the appearance, and consequently the selling value of the whole case, and in the case of most varieties of apples, bruising produces an early decay. Even where there is a market for the fruit as soon as it is gathered, handle it carefully; it will both

look and sell better. Except in the case of early and some varieties season apples, which can be gathered and marketed when only parti all apples should be allowed to remain on the trees till fully grown to develop their full flavour and quality, which will be matured by Keeping varieties of apples if gathered when immature will always sh early varieties when left on the trees too long will become dry an Actual experience is the only means by which the grower can d the exact time or stage at which to gather the fruit, as variety, climate have always to be taken into consideration; but a good gen to go by is—gather early fruit before thoroughly ripe, or it will mealy, but allow late varieties to become thoroughly developed, or shrivel and not mature their full flavour when stored.

Grading, Packing, and Marketing.

I cannot lay too much stress on the grading and packing of the market, as without carefully attending to these most important o the fruit will never show to the best advantage, no matter what it may be; and I am sorry to say that this is a matter that many of t growers of this Colony fail to appreciate the importance of, but s fruit to market anyhow—big and little, good and bad, all mixed up minately—and then they wonder at the bad prices they obtain, and end by throwing all the blame on their agents, and by running do growing generally; whereas the whole blame for their want of succ entirely on their own carelessness.

If the fruit is required for immediate sale after being carefully it should be graded into different sizes, handling the fruit car prevent bruising, and only one size of fruit should be packed in e It should be tightly, evenly, and neatly packed, and on opening the fruit should be equal throughout, the bottom as good as the top. fruit has to be sent a considerable distance, or where it is required fo it should always be sweated a little before packing; and this is ea by allowing the fruit to remain in the picking boxes for two or th and placing the cases where they will get plenty of air. Care s taken to gather the fruit when perfectly dry, and after they have they should be first graded into size and all blemished, wormy, or c imperfect fruit rigidly excluded. After being graded, wrap each fruit in tissue paper—a tough thin paper is best, as it is less likely placing the eye end of the fruit in the centre of the paper, and f twisting the ends of the paper round the stem. In packing the ca the stem end of the fruit downwards, and pack very evenly and t that there will be as little shaking as possible. It is a very good place a layer of wood wool at the top and bottom of the case, as bei elastic nature it prevents in a great measure the bruising of the fru light, neat cases, and always mark the grade and kind of fruit disti the case. It is also a good plan to use a distinguishing brand wh quantities are to be shipped, and the brand should be stamped wrappers and also on the case. If this is done, and a high sta excellence is maintained, there will be no difficulty in disposing of as the dealers in every market always give the preference to any br they know from experience is honestly packed and can be depende but once deceive them and it will take years before you will rega confidence.

e successful marketing of any kind of fruit depends mainly in the
ıer in which it is got up for sale—even grading, honest and neat packing,
xclusion of all blemished or wormy fruit, and the use of light, clean,
cases, will do more to sell the fruit than anything else, as good fruit,
shown, will sell readily, even in a dull market, when the same fruit,
ractively got up, would be often unsaleable.

Storing.

order to develop their highest flavour late varieties of apples should be
ed to remain on the trees till they have attained their full size and are
ıghly ripe, when they should be gathered and stored for keeping; the
maturing and mellowing whilst stored. Fruit for storing requires
areful handling, and all bruised, blemished, or diseased fruit must be
n out. The fruit should only be gathered when perfectly dry, and it
l be stored in a building possessing as even a temperature as possible,
which the ventilation can be easily adjusted. The success in storing
depends mainly on the maintenance of an even temperature not
ling 50°—55° and of a slight but not excessive ventilation, as too
air or too dry air would cause the fruit to shrivel. An expensive or
ate building for storing apples is not at all necessary; the essential
cations for a store are good insulation, so that it is not subject to any
n changes of temperature, moderate ventilation that can be regulated,
moderately dry air. A simple and very good store can be made where
is the slope of a hill available, by cutting away a portion of the side of
ll, so as to form one of the sides and a part of one end of the store
the hill itself; the other side and the balance of the end being formed
ouble wall of slabs having a foot of soil between them. A ceiling of
should also be made having spaces left for ventilation that may be
d or closed as desired, and over the slabs there should be a layer of
6 inches of soil. Over the whole store there should be a roof of bark
n which should extend well beyond the ends and outer side, so that the
ould not be able to beat in. All the water from the roof should be
d right away, and a small surface drain should be made on the hill side
ch any surface water that would otherwise get on to the ceiling and
gh on to the fruit. The side of the store formed by the hill should be
d up, and a floor of slabs should be placed at about 1 foot from the
d, having taken the precaution to put in a good drain to take off all
ge water first. The end at which the fruit is to be taken in and out at
l face the south, and all of this end, except that required for a door,
l be made similarly to the outer side. In the door there should be
g panels for ventilation to be opened or closed, so as to regulate
mount of ventilation required. The fruit may either be stacked in
on the floor, piling the fruit to a height of 2 feet, or what is better,
y be placed on shelves arranged in the middle, round the sides, or
Storing on shelves is preferable, as if any fruit decays it can be
taken out. When first stored the door and the ventilators in the
g should be left open so as to allow the moisture thrown off by the
during the sweating to be carried off, after which the door should be
and the ventilation moderated. Where a hillside is not available and
strong black clayey loam or adobe can be obtained, a good store can be
with walls of sun-dried bricks having a roof projecting well beyond
alls, and having a space between the roof and the wall-plates for
ation. A plaster or slab ceiling can be made and the store can be

fitted up to suit the requirements of the orchardist as previously describ
If adobe is not available a good substitute is made from a clay loam, co
dung, and chopped straw, which is mixed well together and packed tigh
between a double wall of boards placed at such a distance apart as it
wished to make the walls thick. When dry the boards are removed and t
mud or cob-walls remain, but as in the case of the adobe or sun-dried wa
it is necessary to have an overhanging roof so that no rain can get on to t
walls.

Utilising Surplus Fruit.

Drying.—The apple is easily and readily dried, and when good cook
varieties are used and the operation is well and carefully performed t
result is a very saleable article, possessing all the qualities of the fresh fr
and in a compact form that if well packed will keep for years, and may
sent to any market no matter how distant. At present we are practica
dependent on America for our supply of dried apples, the little drying t
is done in the Colony being usually of the very crudest nature. For dryi
large, firm, good cooking acid apples having a white flesh are preferable, l
other kinds may be dried if wished but will not turn out so well. For dry
apples the following outfit is necessary:—

1st. A good combined peeler, corer, and slicer with which to prep the fruit. (Several good patterns are obtainable in Sydney.)
2nd. A sulphurer in which to bleach the fruit when prepared.
3rd. A machine drier or evaporator with which to dry the fruit afte has been sulphured, as owing to the uncertainty of our clim especially in the best apple-growing districts it will rarely be fou practicable to sun-dry to any extent, so that it is better to depe on an evaporator. Several different kinds of evaporators suita for small orcardists are now procurable in Sydney, but if any o is desirous of going in for evaporating on an extensive scale, th it will be advisable either to import a large factory drier or else construct a drier to meet the special requirements.

In drying apples the fruit is first peeled, cored, and sliced, and the slices l
on the evaporator trays. When the trays are full they are placed in t
sulphurer with as little delay as possible as the fruit rapidly discolours af
being cut. The fruit is kept in the sulphurer till properly bleached the ti
for which varies with the different kinds of fruit, but it is better not
sulphur too long or the dried product will taste of sulphur. The bleach
should be long enough to whiten the fruit but no more. After its remo
from the sulphurer the fruit is placed in the evaporator where it rema
till it is sufficiently dry, that is to say, until there is no longer any f
moisture left in the fruit, but the fruit should be pliable and not bak
Generally it is better to place the fruit in large boxes to sweat for a few d
before packing, as during the evaporation some of the fruit is sure to
dried more than the rest and some less and the sweating will even up t
whole. When the fruit has evened up it should be packed in light cl
boxes and be neatly and well got up. In drying apples it takes abou
bushel of green fruit, on an average, to produce 6 lb. of dried fruit. Fi
pounds of fresh apples will produce about 30 lb. of meat and 20 lb. of ref
(core, skin, &c.) and the refuse is also dried and used for jelly-making, o
may be used up whilst fresh for jelly.

As I mentioned in the previous part of this article apples are largely us
for jelly, and for this purpose small fruit or the refuse from the drier m
be used.

Making Jelly.

'ake the whole fruit, slice it, and place it in a steam-jacketed kettle or ge preserving pan, taking care that it is either of copper or lined with mel, the latter being preferable; place a little water over the fruit to vent burning and slowly raise the heat to the boiling-point so that the e of the fruit may be readily extracted, when it is strained off and filtered, that it is quite clear. To every pint of juice now add 1lb. of best fectioner's sugar, place the whole in the preserving pan or steam-jacketed tle and boil gently till a small portion jellies on cooling, when it is ready putting up in glass or tins.

)uring the boiling the jelly should be carefully skimmed so as to remove extraneous matter, as if this is neglected the jelly will not be clear. solute cleanliness in all the utensils and the use of nothing but the best ar are the great secrets in making not only apple jelly, but also all other t, jellies, and jams. The manufacture of cider I treated in a previous cle in the *Gazette* and the manufacture of apple butter I referred to in beginning of this, so I need not refer to them again. As I intend this cle to be as general as possible I think it advisable to conclude with a of and simple description of the principal diseases, both insect and fungus, ch are found in this Colony attacking the apple and apple trees, and ough most of the information has already appeared at different times in *Gazette* I think it may be useful to our fruitgrowers to repeat it here in a densed form.

Diseases of the Apple.

Insect Diseases—Codling Moth.

It the present time no insect is causing more trouble to the apple grower n the Codling Moth, the larvæ of which have destroyed the greater tion of the apple and pear crops in many districts during the last few rs and have now spread to nearly every part of the Colony except isolated tricts, and the pest is still rapidly spreading.

[will not describe the insect in detail, but anyone who wishes to obtain the t and fullest information on the subject cannot do better than study Mr. liff's article, which was published in the *Agricultural Gazette*, Vol. I, p. 3. [he life history of the insect is briefly as follows:—During the winter the væ remain hidden under pieces of loose bark on the trees, in holes or cks of the trees, in stakes adjoining trees, in empty fruit cases, buildings ere fruit has been stored, fences adjacent to apple or pear trees that have n affected, and other places where they can find a snug and dry retreat. the approach of spring the larvæ pupate and when the trees are in ssom the moths hatch out. Just as the petals are falling, that is when fruit is setting, the female moths lay eggs in the calyx of the young it, rarely laying more than one egg in each fruit. The egg remains in calyx of the fruit for a time before hatching, but as soon as the young rm or larvæ emerges from the egg, it starts to eat round the calyx of the uit, and then burrows into the fruit, developing with the fruit till it reaches turity, when it either falls to the ground with the fruit or else it lets elf to the ground with its spinaret. On reaching the ground it at once oceeds to the tree or other adjacent shelter, seeks out a secure retreat, ins its cocoon, pupates and again turns into a moth. This time the moth ys its eggs either in the calyx or anywhere on the fruit where there is tle chance of the egg being destroyed, such as where two fruit touch each

other. The egg develops and the larvæ eats its way into the fruit previously described. In all parts of the Colony there are at least t crops, and in the warmer parts three in a season, so that the pest sprea very rapidly. The means of combating the codlin moth are very simple, a if universally carried out would soon result in greatly reducing the amou of damage done. They consist firstly in spraying the trees in spring, just the fruit is setting, with Paris green, a trace of the poison being carried means of the spray into the eye of the fruit where the moth lays its eg As previously described, the young larvæ usually eats round the eye calyx first before boring into the fruit, and if there is any Paris gre present in the calyx then it is very probable a portion will be eaten by t larvæ when it will be at once destroyed. As the moths do not all hatch at the same time it is advisable to repeat the spraying in a fortnight. spraying for codlin moth with Paris green the following precautions mu be carefully attended to. Never use stronger than 1 lb. of Paris green 160 gallons of water, keep the mixture well stirred whilst using, and ne spray in a burning sun or on a very windy day. The second remedy is catch the larvæ as they leave the fruit, and this is done by carefu removing any shelter that may exist on the tree itself or adjacent to t tree, and then tying a band formed from a piece of a grain sack or ot suitable material tightly round the trunk of the tree. The band should from 4 to 6 inches wide and long enough to go round the trunk and should be very tightly tied on, the string being placed in the centre and t upper portion of the band turned over it. All other shelter having be destroyed the larvæ find their way to the band and spin up in it. At le once a week the bands should be examined and all larvæ found in th destroyed. The easiest and quickest way to destroy the larvæ is to have t sets of bands, the bands containing the insects are taken off, placed in a so that no insects can escape, and clean bands are put on in their place, fi taking care to destroy any larvæ that may be found attached to the tru itself. The easiest way to destroy the larvæ in the bandages is to place t bandages in boiling water for about five minutes. This is surer, quick and cleaner than killing the insects with the fingers, and also when t

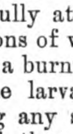


Fig. 10.
Moth—Natural size.

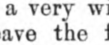


Fig. 11.
Pupae—Natural size.

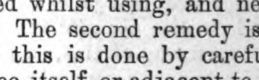
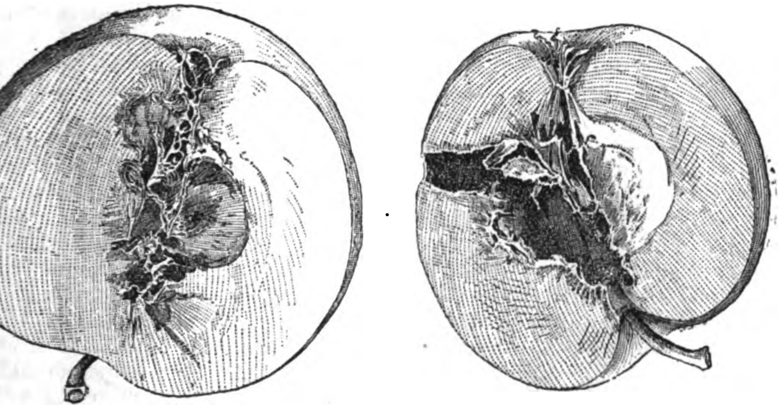


Fig. 12.
Larvae magnified.

insects are crushed in the bandages, the bandages often become infest with small ants feeding on the dead larvæ and which so worry any lar that come to the band that they go elsewhere and are not caught.

In addition to the spraying and banding it is also advisabie to destroy infested fruit, and during the winter the trees should be well attended All loose bark should be remned, using for this purpose a triangular scrap such as is used on board ship, and all crevices or other places likely harbour any larvæ should be carefully examined, and all larvæ fou destroyed. All fruit cases that have held infested fruit should be careful examined, and if they contain any larvæ they should be kept in boiling wat for at least ten minutes. A thorough disinfection of fruit cases will

d of the greatest value, as in addition to destroying the larvæ of the h the germs of many fungus diseases will also be killed. Any other es likely to harbour any of the insects should be well overhauled, and



Figs. 13 and 14.—Fruit attacked.

larvæ killed whenever and wherever they may be found. If these edies are properly and universally carried out, and this can only be done concerted action on the part of our fruit-growers, the codling moth will be a thing of the past, or only exist in such numbers as to do comtively little damage.

he above drawings show the appearance of the insect in its different es, and also the way in which they destroy the fruit.

Woolly Aphis or American Blight.

Iext to the codling moth the woolly aphis is the worst insect pest that le-growers have to contend with, and it is a pest that requires the most eful and constant attention on the part of the orchardist to keep in ck—as once let an orchard become thoroughly infested, root and branch, it is an exceedingly hard if not well nigh hopeless job trying to eradie the disease; but if taken in time and checked before it is able to spread ny extent, then with a little care and attention at intervals it may be t within bounds and do little harm. In the previous part of this article, en treating of stocks for the apple, I strongly emphasized the necessity working all apple-trees on blight-resistant stocks, as by so doing the ges of the insects are confined to the portion of the trees above ground, the roots are free and do not form a breeding ground with which to lenish the tops of the trees when the insects have been killed off by aying. The following illustrations show the appearance and effect of the ects in roots and branches.

he following are the best remedies for the woolly aphis:—

. The use of resistant stocks.

. When the roots are infested the insects may be destroyed by injecting ulphide of carbon into the ground, as done in the case of the Phylloxera

of the grape, or the insects may be made to leave the roots by forking h
lime or a little gas lime into the soil near the roots. Night-soil forked

Fig. 15.—Root very badly infested.

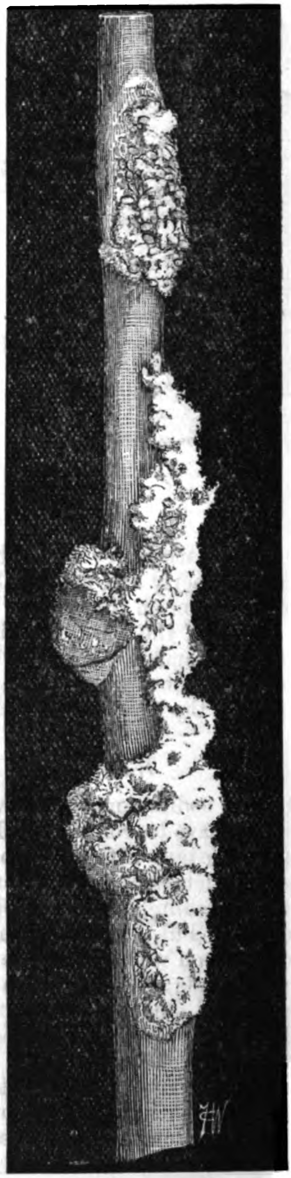


Fig. 16.—Affected branch (small).

round the roots will also cause the insects to leave, and this remedy a
often drives the insects from the top of the tree as well.

3. Where the insects infest the top of the tree, the quickest and cheapest nedy is to spray the tree with the resin and soda wash, made as follows:—

Resin and Soda Wash.—Take 4lb. of resin and 3lb. of washing soda, d boil in two gallons of water, adding water slowly to make up five lons boiling all the time. The mixture should be boiled till the resin is oroughly dissolved, which is known by the mixture becoming of a brown our. Water is now added to make forty gallons of wash, when it is ready use. This wash works easier in the pump, and is more efficacious when plied at a temperature of about 130°. It is an exceedingly cheap and cacious wash, and will not injure the fruit or foliage in the slightest, and has the advantage of killing large numbers of aphis eggs, as well as the fect insects. This is done by covering them with a glaze or varnish of in, which prevents the eggs hatching. It should be applied at any time t the aphis are to be found, except during a burning hot day, or with a ong drying wind blowing.

The spray should be applied with as much force as possible, as in order destroy the insects it is first necessary to knock off the woolly covering h which they are protected before the spray can have any effect on them. e best nozzle for this purpose with which I am acquainted is the Nixon e illustration), as the spray produced by it is direct, fine, and when a od pump is used has great force.

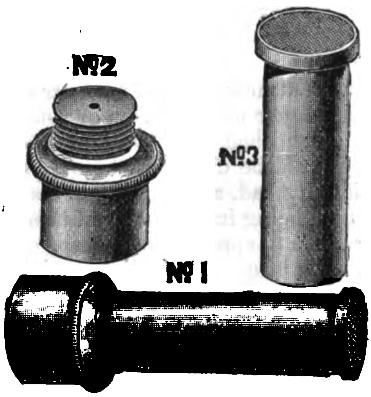


Fig. 17.—Nixon's nozzle—four of these nozzles of two sizes go with each No. 3 Climax Spraying pump.

When the insects are not numerous they may be kept in check by earing the affected parts with castor oil, but where they are at all plentiful e spray pump is the best thing to use. In pruning varieties that are bad ghters, it is a good plan to cover all the larger cut surfaces with grafting x-rubber paint or shellac varnish, as newly-cut surfaces are always very ble to attack.

Mussel Scales—(Mytilaspis citricola).

These insects, which get their name from a resemblance to a mussel shell, e by suction on the sap of the tree or on the juice of the fruit. In their rlier stages they travel about the tree seeking for a suitable spot to which attach themselves, and to which, when found, they remain attached for

the rest of their existence, the body of the mature insect becoming finally a mere receptacle nearly filled with eggs or young scales. When these insects are present in large numbers they very seriously affect the vigour and health

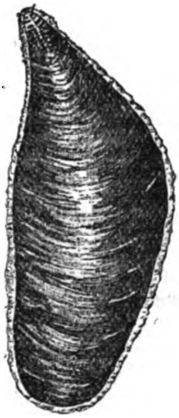


Fig. 18.—*Mytilaspis citricola*—Upper side, much enlarged.

Fig. 19.—*Mytilaspis citricala*—Under side, much enlarged, showing the eggs.

of the tree to which they are attached, and if measures are not taken to destro them they will eventually either kill the tree or render it valueless. Thes scales are already well established in several parts of the Colony, and ar spreading, so that they should be checked wherever seen. In some parts c Tasmania they are evidently bad, as large numbers of apples more or les covered with them are now being imported from there into this Colony, an these infested fruits promise to spread the disease. The insects attack bot the fruit and the wood, both large and small branches, and are sometimes s

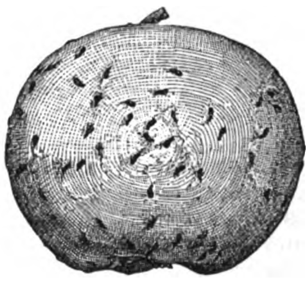


Fig. 20.

numerous on the wood that they entirely cover it. When they attack th fruit they greatly disfigure it, the part or parts of the fruit to which th insects are attached being contracted in its growth as compared with th portion of the fruit that is free.

he following drawings show the mature female scale (*mytilaspis citricola*) h enlarged, and the effect and appearance of the insects on the fruit and d, the insects being rather under natural size :—

he enlarged drawing of the female scale shows the egg sac and gives an of how prolific these insects are, and of how quickly they increase when olested. In addition to attacking the apple, this scale infests the thorn as well, and if for this reason only, I strongly disapprove of the

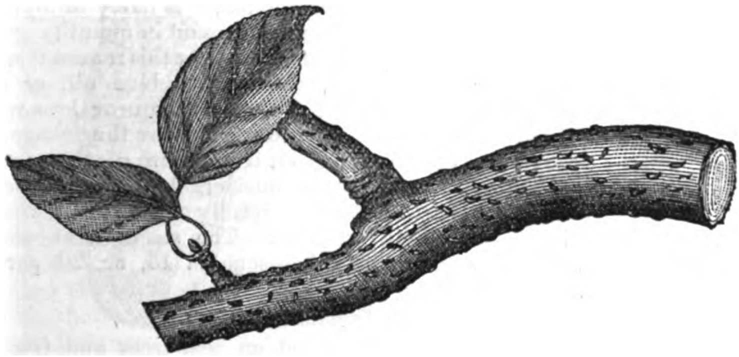


Fig. 21.

of thorn hedges as fences or shelters for apple orchards as they form a our from which it is practically impossible to dislodge the scales, and therefore a breeding ground for them and from which the scales can y spread to the orchard. The two species of mussel scale, mytilaspis orum and mytilaspis citricola are very similar in appearance, but differ itly in colour and shape. The damage done by either species is the same, the same remedies are used.

he means by which these insects may be destroyed are as follows :—

1st.—Where the trees are very badly affected, the trunks and main branches should be scraped to remove the scales, the rest of the tree being sprayed.

2nd.—Spraying during the winter with a strong caustic wash that will destroy the mature scales. For this purpose Rovery's scale exterminator or a resin wash made as follows will answer: Take 20 lb. of resin, 6 lb. of caustic soda (70 per cent.), 3 pints of fish oil, water to make 80 gallons; place the resin, caustic soda, and fish oil in a larger boiler with 20 gallons of water, and boil for three hours, then add hot water slowly, and stir well till there are, at least, 40 gallons of hot solution; then add cold water to make up the total to 54 gallons. Never add cold water when cooking or the resin will be precipitated, and it will be difficult to get it in solution.

3rd.—Spraying during the spring when the young scales are hatching out and when they are tender and easily killed with the resin and soda wash recommended in the case of the woolly aphis. The spraying should be repeated several times at intervals of a week as the young scales do not all hatch out at once, and the younger they are sprayed the easier they are killed. If wished, kerosene emulsion made as follows can be used in the place of the resin and

soda wash: Take 1 gallon of best kerosene, 1 gallon of boili water, and 8 oz. of soft soap. Dissolve the soap in the boili water; when dissolved add the kerosene, and churn the mixtu with a spray pump or syringe for fully ten minutes, so as to the oil and the water thoroughly emulsified when the mixtu becomes stable, and the oil will not separate from the water w standing, and on cooling the mixture becomes of the consister and appearance of cream. If the oil is not thoroughly emulsifi and there is free oil present when applied, it is likely to injure foliage if not defoliate the tree, and if free oil in quantity gets to the roots it will probably kill the tree. For this reason it is sa to use the best kerosene in preference to blue oil, or wo preserving oil, as the latter always contains more or less vola oils which will not emulsify, and always destroy the foliage m or less,—though it is just as effective, if not more so, than the b kerosene. Kerosene emulsion is considerably dearer than resin and soda wash; and if not carefully made, or if used strong, it is apt to injure the trees. The strength at which should be used is one part of kerosene in 15, or 20 parts emulsion.

Greedy Scale—(Aspidiotus rapax).

This insect, though most frequently found on pear-trees and fruit, a infests the apple as well. The insects are most numerous on the smal branches, especially at joints and on fruit spurs, and when present in la quantities they seriously affect the growth and vigour of the tree; they a attack the fruit, confining their ravages generally to the basin surround the eye, so that they do not disfigure the fruit to any extent.

The remedies are the same as those recommended in the case of the mus scale.

Ground Crickets—(Gryllus servillei).

This well-known insect often causes considerable damage to young app trees by eating the bark at the collar of the tree just below the surface the ground, which, if neglected or not seen to in time, ringbarks, a consequently kills the tree. The insects also eat the bark off the limbs a devour the foliage. The best remedies to use are, first, to keep the orcha in a high state of cultivation and free from weeds, thereby destroying shelter under which the insects would harbour; second, spraying the tr with Paris green, at a strength not exceeding 1 lb. of Paris green to 1 gallons of water, which will destroy all the insects that eat either the lea or the bark; third, poisoning the insects by means of arsenic, as follow Take 1 oz. of white arsenic, and 6 lb. of oatmeal or pollards, mix thoroug and add enough treacle to make a stiff dough when kneaded; take a pie of the dough about the size of a walnut and place it under a shingle at near the root of the tree. The insects will go under the shingle for shelt eat the poisoned dough and die. Large numbers are easily and cheap killed in this manner.

Red Spider.

During the winter, if the tree is carefully examined, a large number very small round red eggs will often be noted, especially in the joi of the wood and in any roughness of the bark of the young wood. The are the eggs of the red spider, a minute insect, or rather a species spinning mite that often does considerable damage to orchards. The you insects hatch out in spring, and often congregate in large numbers rou

stems of the fruit, sucking them and causing the fruit to fall. They also ack the foliage, and their presence may be readily detected by the silvery greyish colour they give to the leaves. During the winter the eggs may destroyed by spraying the trees with a strong caustic resinous wash, as ommended for scales, or the insects may be readily and easily destroyed spring by means of the resin and soda wash. Sulphuring the trees in the ly morning, when the young spiders are hatching out, is said to be a cheap l effectual remedy in California.

Harlequin Fruit Bug.

This insect often appears on apple-trees in very large numbers, especially en the fruit is ripening, and is said to cause considerable damage to the it by piercing the skin and obtaining nourishment from the fruit by tion. By some authorities it is considered to be the cause of the disease ich is described further on, under the head of "Bitter Pit," but in this I not agree, neither can Dr. Cobb, our pathologist, after having made eral careful investigations. That the insects pierce the fruit is absolutely tain, but that they are the immediate cause of "Bitter Pit" is exceedingly probable.

During the winter the insects often congregate in large masses under any ilable shelter, when they may be easily destroyed, and at any other time ey are destroyed easily by spraying with kerosene emulsion.

Various.

There are a large number of different kinds of insects that do considerable mage to apple-trees by devouring the foliage or bark or stem of the fruit, which the following are a few of the commonest:—leaf-eating caterpillars all kinds, leaf-eating beetles, beetles or caterpillars feeding on the skin of e fruit, grasshoppers and case moths, and for all these insects that live by tually devouring a portion of the tree there is one remedy, and that a very nple and effective one, and that is to spray the trees affected with Paris een, taking care to always use the poison with caution, as noted when eating the codlin moth.

Hares.

Hares often do considerable damage to young apple-trees, and even trees of considerable size, by eating the bark off the trees, often mpletely ringing them. The best remedy, and the cheapest in the long n, is to surround the orchard with rabbit-proof netting; but where the chardist is unable to pay for this, then the trees may be protected by nearing the trunks and lower branches with a lime-wash made from the ent lime from a tanyard, or with a mixture of blood and resin, neither of hich will be touched by hares. When the tree is not entirely ruined, it ay be brought round by smearing all the barked portion with fresh cow-ing, and binding a hay or straw rope round the trunk so as to protect it om the air as much as possible, when new bark will form rapidly, especially the under bark is intact or nearly so.

Fungus Diseases.

Most of the fungus diseases of the apple having been fully dealt with in e April number of the *Agricultural Gazette* for 1892, I beg to refer any-ne who is desirous of obtaining fuller information than that contained in e following condensed description of the different diseases to what was en published. All the illustrations are made from life and most of those ven are reproduced from the article refered to.

Apple-scab, Tasmanian black-spot—(Fusecladium dendriticum).

Of all the various fungus diseases of the apple none is more widel distributed or the cause of more loss than the apple-scab. The diseas attacks both the leaves and the fruit and its general appearance is well show

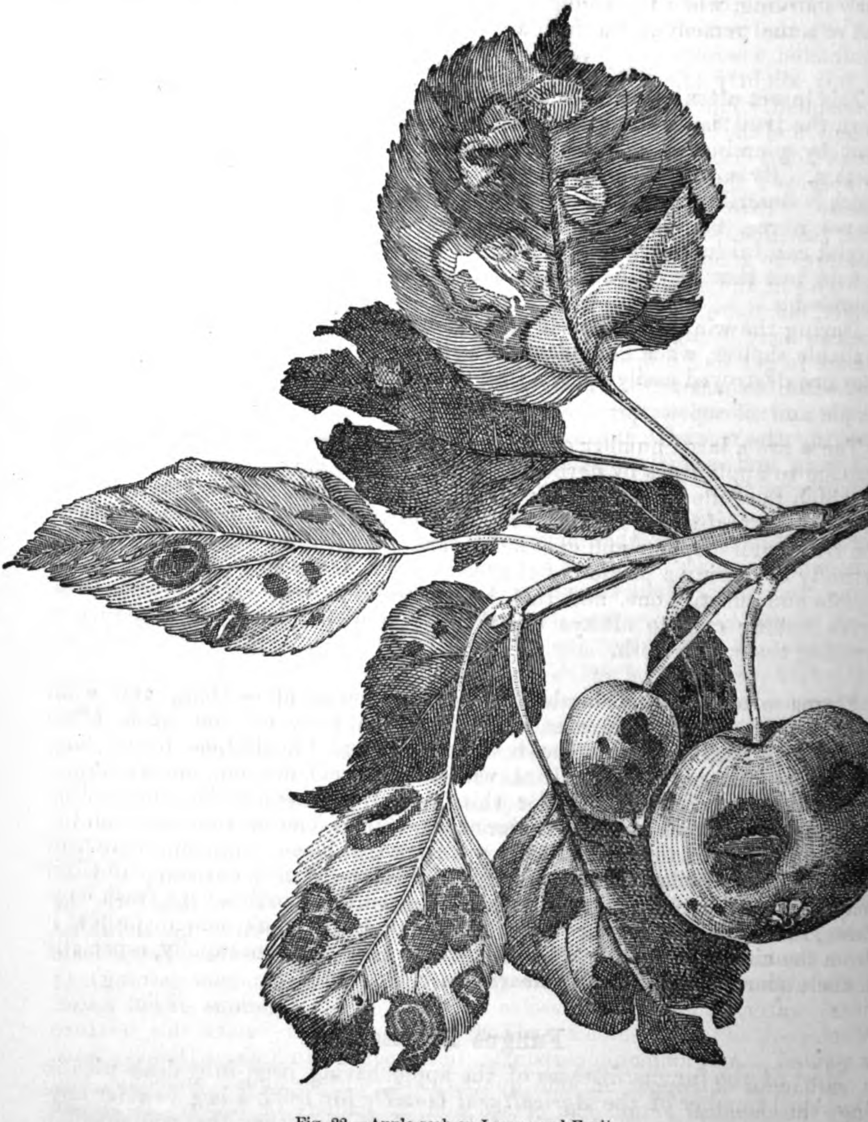


Fig. 22.—Apple-scab on Leaves and Fruit.

in the accompanying illustration. The black spots on the fruit and leaves are covered with thousands of spores and these spores remain on the tree in a

dormant condition during the winter and on the approach of spring start into growth attacking the young leaves and fruit as soon as they make their appearance, but the fungus is not easily discernible till it has developed to a considerable extent, when it may be seen in the form of dark green patches on the leaves and of dark spots on the stems of the young fruit, which rapidly turns black and falls off. In some cases the whole crop is destroyed and the leaves are scorched and blistered almost as if by the action of fire. When not so some portion of the fruit sets, but all that is at all badly affected is contracted wherever the fungus is, and is worthless. Even where the fruit is only slightly affected its appearance is spoilt and its selling value is consequently much lessened. This disease is spreading very rapidly in this Colony, and the large amount of Tasmanian fruit affected with this disease that is now being brought into the Colony will tend to spread it very much faster, as wherever the diseased fruit goes there is a chance of its spreading the disease. Every fruit-grower should make himself thoroughly conversant with this disease, and on its making its appearance should take stringent measures to stamp it out before it has time to become firmly established and to over-run and ruin the orchard. This refers to all other fungus diseases as well, as there is a time when with a little care and attention all fungus diseases may be readily kept under, but which if neglected will allow the disease to get such a firm hold of the orchard that it will be a very difficult and often expensive job to erradicate it. The remedy for apple-scab is simple and efficacious, provided it is properly carried out, and it consists in spraying the tree with Bordeaux mixture first, just as the buds are bursting in spring, and secondly, just as the fruit is setting. These two sprayings, if properly applied, are usually sufficient as they destroy the spores of the fungus just as they are starting into growth. If, however, the two sprayings are not sufficient further sprayings may be used, using eau céleste or ammonio carbonate of copper in the place of the Bordeaux mixture, but I advise that the first two sprayings be done with Bordeaux mixture. Several other remedies are advocated but none are superior to those mentioned, and where used in this Colony the Bordeaux mixture, applied as described, has given very satisfactory results.

Bordeaux mixture is made as follows:—Take 6 lb. of sulphate of copper (bluestone), 4 lb. unslacked lime, 22 gallons water. Dissolve the 6 lb. of bluestone in 4 gallons of hot water. Dissolve 4 lb. of quick-lime in 2 gallons of water. When cool, mix and make up to 22 gallons with more water; strain and keep constantly stirred whilst using. Use good lime free from sand, and apply with a spray-pump fitted with a Nixon nozzle. If Codling Moth has to be fought, as well as scab, then the second spraying, that just as the fruit is setting, should contain Paris green in the proportion of 1 lb. of Paris green to 160 gallons of Bordeaux mixture. Used in this form the Paris green will do less harm to the foliage than when used alone, and it has also a beneficial effect as a fungicide as well as an insecticide. Eau céleste is made thus:—Copper sulphate (bluestone), 1 lb.; ammonia (strong), 1½ pints; water, 22 gallons. Dissolve the bluestone in 2 gallons of hot water. When cool, add the ammonia—add 20 gallons of water—make this mixture as wanted. And ammonio-carbonate of copper as follows:—Dissolve 3 oz. of carbonate of copper in one quart of strongest liquid ammonia, and when the chemical action has ceased add 22 gallons of water. Both eau céleste and ammonio-carbonate of copper are best applied with the triple cyclone nozzle.

Powdery Mildew (Podosphaera Kunzei, Lev.)

The presence of this fungus is readily detected in an apple orchard b nnumber of the branches of the trees affected having either dead tips, wh are of a greyish white black colour, or having tu of small sized leaves cove with a thick greyish wh down at their extremiti and it is from this lat characteristic that the fun derives its name. The disea leaves and twigs are whit at first, but as the dise advances they become bla ened, and finally the t dies. In some instances limbs attacked die back the greater portion of th length, when the disease erroneously called "f blight," a term that is m properly applicable to sc It is a difficult matter make a drawing of t disease by which it may readily identified, but illustration of the dise drawn by the departmen artist from a specimen o tained from a winter pe main-tree should enable a fruitgrower to distinguish t disease at once. Powd mildew is widely distribu over the Colony, but as rule it confines its attac to a few varieties, the win pearmain being especia subject to it. The remed for the disease are to c off and burn all diseas branches and to spray t trees when the buds bursting in spring w Bordeaux mixture, and follow this dressing with t ammonio-carbonate of copp when the leaves are ab half formed; this latter m ture to be repeated at tervals of 10 days as of as necessary. The recipes for making Bordeaux mixture and ammon carbonate of copper are given under the heading of apple scab.

Fig. 23

Bitter-Rot (Glœosporium versicolor).

This disease is also called the Ripe-Rot as it only makes its appearance when the fruit is ripening. Its appearance is very characteristic. First, it is a small, round, soft, brown spot which rapidly increases in size and varies somewhat in colour. Small pustules of a purplish colour then appear on

Fig. 24.—Apple, one-half natural size, attacked at two places by ripe-rot or bitter-rot. The apple is cut so as to show how the right-hand rot has penetrated towards the core. The pustules of the fungus are represented by dark spots on surface of the two rotted places.

the surface of the rot and burst, but the rot goes on spreading till the whole fruit is diseased. Early apples are usually most affected by this disease, the Irish peach being especially subject to it. The remedies are, first, to gather up and destroy all diseased fruit, and secondly, to spray, just as the fruit begins to ripen, with the ammonio-carbonate of copper, repeating the spraying at intervals of ten days as long as necessary.

Mouldy Core.

The following description of this disease I have taken from Dr. Cobb's report:—

"This is a diseased condition brought about by the presence of common mould in the core of certain varieties of apple. Outwardly such apples often appear to be quite sound, but on cutting them in halves the core is found to be in a mouldy or half rotten state. This, however, is only the

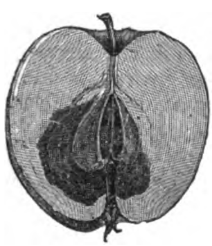


Fig. 25.—Half an apple, showing how a brown rot, due to mouldiness at the core, arises and progresses toward the surface of the apple. The rot is shown dark coloured.

beginning of the trouble, for sooner or later the whole apple becomes rotten and worthless. The rot arising from this cause has an appearance different from that of the bitter-rot, inasmuch as there are no concentrically arranged pustules, and, furthermore this rot works from the centre outward, instead of beginning as a spot on the surface and working inward.

The way in which the mould gains an entrance to the core of the app
will be seen at once if one of the diseased apples be split in halves with
sharp knife. It will be found that the blossom end is open so as to form
passage leading to the core. Ordinarily, only the varieties with op
blossom ends are subject to this disease.

The remedy therefore is not to grow apples having a direct opening fro
the eye to the core. No other cure can be suggested. The only valuab
apple that is extensively grown in this Colony that often possesses this dra
back of having an open tube is the Five Crown or London Pippin, whic
on account of its comparative freedom from woolly aphis, and being a go
bearer and seller, is a general favourite in the colder parts of the Colony.

Bitter-Pit.

This is the name given by Dr. Cobb to an unidentified disease which
spreading rapidly in the Colony, and is very bad in several parts with certa
varieties, though few, if any, apples are entirely free. The disease is easi
distinguished, the fruit affected being spotted or pitted on the surface, a
if the skin is removed from the spots or pits a dry spongy brown mass

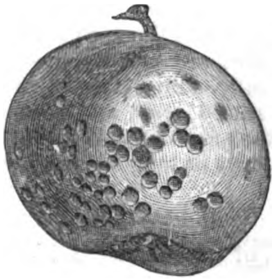


Fig. 25.

seen, which is very bitter to the taste. The disease when at all seve
renders the fruit quite inedible, and even when it only causes the fruit
be slightly spotted it detracts considerably from the selling value of t
fruit, as the diseased fruit will not keep—usually going dry and not rotti
—the disease being altogether distinct from the "Bitter-Rot."

No remedy can be suggested for this disease, but the Department will
glad to hear if the disease is as prevalent in trees that have been spray
for scab, bitter-rot, or powdery mildew, as in unsprayed trees.

Water-core.

When an apple instead of being quite opaque is partly or wholly tra
parent it is said to be affected by water-core.

There is no known remedy, and the best thing I can suggest is to refra
from growing the kinds that are most subject to it, unless, as in the case
the winter pearmain, they are of especial merit.

Canker.

This is a term that is given to a fungus that attacks both the wood a
the fruit. Its appearance on the wood is easily distinguished, as it caus
irregular shaped cracks with smaller cracks branching out from the ma
crack, and occasionally it encircles a limb or branch and completely destro

it. Its effect on the fruit is often apt to be confounded with scab, as like scab it often cracks the fruit, but it can easily be distinguished from scab by the absence of the roundish patches and dark greenish spores of that fungus. Canker being usually much browner, rougher, and more irregular in shape. Canker is easily kept in check by pruning out and burning the worst affected branches, and by giving the tree a good coat of lime-wash which can be readily put on with a spray-pump, using a coarse nozzle. Bordeaux mixture, containing a large proportion of lime, is also equally efficacious.

Lichens and Moss.

These parasitical growths are easily destroyed by spraying with lime-wash or Bordeaux mixture.

Sun Scald.

When dealing with the pruning of the apple I pointed out the necessity of so growing the tree that the trunk is protected by the head, and also that the head of the tree is not opened out to such an extent as to permit the sun to strike directly on the bark of the branches in the centre of the tree. When the sun strikes directly on the unprotected bark of any portion of the tree it heats the bark to such a degree that the sap is over-heated and starts fermenting, the result being that either the side directly exposed to the sun is entirely killed, or the whole branch or side of the tree is destroyed, usually dying off so rapidly that it is attributed to what is usually termed "fire-blight." Even where the limb is only partially killed the tree is permanently injured, as the dead portion of the wood becomes rapidly infested with borers. In the case of young trees or of older trees that are headed high, and are of an upright habit of growth, it is a good plan to place a Hobart paling on the west side of the tree to protect it from the afternoon sun, as it is always the afternoon sun that is the most scorching, and that does the damage. Proper pruning so as to produce the necessary foliage with which to protect the branches, and to grow the branches in the right positions is the best cure for the sun-scald or "fire-blight."

Sour Sap and Scalded Roots.

Thorough drainage that will prevent the accumulation of sour or stagnant water round the roots of the trees is the best cure for this disease. And if the land is of a heavy and retentive nature as well as being sour a good dressing of not less than 2 or 3 tons of hot lime to the acre will have a very good effect.

The Vineyard and the Cellar.

By J. A. DESPEISSIS.

The Cellar.

During the month of February, preparations should be actively pushed forward for the coming vintage. The casks, vats, presses, grape-mill, &c., should be completely overhauled, scrubbed, washed out and cleansed *thoroughly* and kept in readiness—steam, hot water, washing soda, lime, hard brushes, brooms and plenty of elbow grease will assist in doing this.

The operation of racking off last season's wine for the third or the fourth time as required, should be pushed forward and as much of the older wine as possible, removed from the fermenting-house, or the air in this part of the cellar will soon be teeming with germs of fermentation which might perhaps get access to the already made wine and disturb it by starting it working again.

As it is more than likely the presses and some of the vats will have shrunk during the hot summer months, the hoops should be driven carefully and bagging soaked with water put wherever necessary on the joints, so as to enable the timber to swell and the leakage to take up.

The neglect of thoroughly disinfecting the vessels used during vintage is in many cases responsible for the ulterior damage caused to the wine by *mouldiness*, and many a well-fermented wine has been spoiled by a taste of bad cask or new wood. The wine-maker cannot therefore pay too much attention to this most important work of cleaning, and he should satisfy himself that every single utensil or vessel used for securing the new vintage has been most scrupulously cleaned, seasoned, and disinfected.

A mere scrubbing with a hard brush and water will often clean a cask temporarily, but the meshwork of mould threads which have penetrated through the pores of the wood have not been destroyed, and, a few days after a superficial cleaning, will appear as bad as ever.

Whenever such is the case the following methods of treating casks, &c., badly infected, will be found useful:—

For casks: Pour into the vessel 125 grammes of chloride of sodium dissolved in a gallon of water; for every 100 gallons of capacity of the cask (¼lb.) and a small quantity of dilute sulphuric acid—drive the bung in and let the chemical reaction set in inside the cask. Under the influence of the sulphuric acid, chlorine fumes are disengaged from the chloride of lime, and effect a complete disinfection.

This chlorine gas, however, should be removed before putting any wine into the cask, by reason of its strong irritating action on the tissues of the stomach, as well as of its pronounced bleaching action which would decolorise the wine.

For this purpose the cask is washed thoroughly by means of water, after the bung, and in the case of a large size cask, the manhole door, has been removed. A good length of sulphur match will then be burned in the cask after it has drained, the sulphur fumes neutralising completely the chloride gas. A last rinsing out, will then be effected and the cask will be ready for use.

This method, although very efficacious, requires to be applied with a certain amount of care.

Another method, which is also very efficacious and is applicable to open vats as well, consists in cleaning and scrubbing the vessel as well as possible and whitewashing it carefully inside with a limewash made of 2lb. of quick-lime per 100 gallons capacity of the cask, with just sufficient water added to reduce it to the consistency of a thin paint. That limewash is left to stand for two or three days, and is then washed off. When dry, methylated spirit can rapidly be applied by means of a brush, whenever necessary, and then ignited.

The taste of wood in many cases taints what would otherwise have been good wine. It is a popular fallacy that because a cask has just been received from the cooperage establishment and made from new wood it is fit to receive wine straight away. Casks are besides unfortunately ordered at the last moment from the cooper, and very often the picking of the grapes is delayed until the arrival of the cask, accompanied by a note from the cooper that the timber has been seasoned and the cask steamed. As a matter of fact, the staves are still full of sappy and resinous matters, easily extracted by the alcohol in the wine, and will, unless removed, give to the first wine put in it an unpleasant and peculiar woody taste.

For this purpose several methods are in use. (1.) Fill the cask or vat with hot water, with 7lb. to 8lb. of common salt per 100 gallons capacity, and let stand for a day or two; then run the water out and rinse the cask well with pure water. (2.) Another method, which is even better, consists in filling the vessel with water, either cold or tepid, and adding a handful of washing soda or potash for every 50 gallons in capacity. Let stand for several days; run out the liquid, which will have extracted a brown colour out of the wood. Fill with clean water, let stand for a day or so, and run it out. If the water is not quite colourless, fill again, and run out in a day or two. Let the cask drain, sulphur lightly, and the cask is then ready for use.

Beware of swamp and stagnant water coming from holes with a lot of rotten vegetable matter in it, as it will communicate an unpleasant taste to the wine. Rain water or soft water from a clear spring or stream is the best.

Vintage is the all-engrossing preoccupation during the month of March.

In the country north of Sydney the early ripening grapes have probably been gathered by this time, but the bulk of the crop still stands unpicked. Whilst in the southern and later districts the grapes are just getting ready to be picked.

As vintage time is fast approaching, a few seasonable notes respecting that critical process of the conversion into sound, marketable wine of the produce of our vineyards will be acceptable to a great many wine-growers.

Good wine may be said to be the result of securing the presence in sound casks of good must from healthy grapes, good ferments, and a suitable temperature, &c.

Clean Casks.

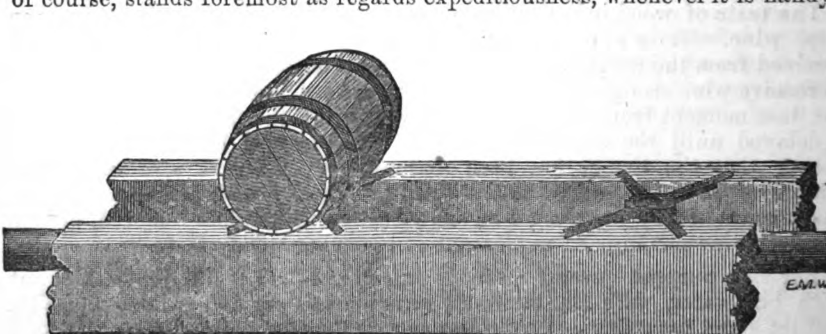
I have purposely given prominence to sound casks, as I can call to memor the almost repellant and certainly unpleasant task of tasting in cella scattered all over this country, from thousands of gallons, what would hav been excellent wine if it had not been irremediably spoilt by tainted caskag

Preparatory to vintage, and before the first grape is picked, the win grower should have all his caskage thoroughly overhauled, examined, rins out, brushed, dried, and sulphured.

Amongst the several diseases that affect wines, mouldiness and acetific tion can in almost every case be traced back to dirty and tainted casks- and acetification, lactic fermentation, ropiness to defective fermentation.

In every case of disease of wine, it may be said, prevention is easy, ar cure very often beyond practicable reach.

It is surprising how few know how to clean a cask. Super-heated stear of course, stands foremost as regards expeditiousness, whenever it is handy



F g. 1.—A simple cask-steaming apparatus is here shown, and consists of iron crosses fixed to wood bearers ; a steam pipe runs along between the bearers, with a nozzle fixed in the centre of the cross. The cock is placed with the bunghole over the nozzle, and steam admitted, which cleanses the cask.

The following method, too, I have always advised, and whenever it has bee practised not a gallon of wine was ever tainted through bad caskage—viz :-

The cask having been emptied, either after the operation of racking, c say on its delivery from the hands of the cooper—if a big cask with a door t it a man gets in, if the cask is very dirty a couple of bucketsful of water ar thrown into it, and with a straw broom, the cask is well washed all round an the dirty water swept out into a tub left standing under the man-hole t collect it—a couple of bucketsful of hot water with a couple of handsful c washing soda, for a 500 gallon cask or a little more for a 1,000 gallon vesse are thrown into it—with a hard brush—I have found cask brushes I purposel got out and made of steel wires and hard, coarse fibre invaluable for th purpose and of splendid wear—both heads and the interior of the cask a round are then throughly scrubbed. By the time the operation is finished the water is very dirty and as black as ink ; this dark wash is swept out c the cask and two fresh bucketsful of hot water and soda are thrown in, th

N.B.—For a more general dissertation upon the question of wine fermentation, ou readers will please refer to a paper from Mr. J. A. Despeissis published in the *Agricultura Gazette* of N.S.W., Vol. II., Pt. 6.

operation of scrubbing being repeated—the wash having been swept out into the tub in front of the man-hole, a couple bucketsful of clean cold water are thrown in and the cask well swept out with a straw broom dipped in the water —the operation is finished by swirling water all round the interior of the cask by means of a tin dipper. This water is then got out and the man comes out of his steamy cask, looking as if he was fresh from a Turkish bath. The next day, when the cask is dry (which is important) a sulphur rag is burnt in it—the door screwed on and the plug driven in. This sulphuring should be repeated every two months or so, should the cask be left empty—should the cask be wet at the time of sulphuring hydrogen sulphide would be produced which would impart to the wine an abominable smell.

When the cask is mouldy or smells sour, which should seldom if ever occur in a properly conducted cellar, a good swabbing of the cask with a solution of sulphuric acid in ten to fifteen times its weight in water, after the first rinsing out with water and prior to the scrubbing with the hot water and soda, will, in the majority of cases, restore a slightly-tainted cask to soundness. This practice I invariably follow, whenever I receive new casks from outside, and I feel justified by results in recommending it. For other methods of cleansing and disinfecting mouldy casks I would refer to the notes for the month of February.

Good Must.

The next point of importance is good must. This I will pass over lightly as, owing to the favourable climatic conditions which are met with in this country, whenever the choicer varieties of wine grapes grown are brought to the cellar the must is, when the grapes have been well tended, of such a quality as in almost every case to make good wine. To those vine-growers who have on hand a large stock of wine difficult to sell, I would strongly urge the gradual elimination from their vineyards of all except the choicest varieties of vines so as to raise in years to come the standard of excellence of their wine. To those about to plant, judicious consideration before planting will be found advisable. Good red wine made of the Shiraz, Carbinet, Malbec, Verdot and Pineau grapes will always sell and command a paying price. Amongst white wines the Reisling, Verdeilho, Tokay and Aucarot, will produce a wine that will sell readily. Brown Muscat of Frontignan, in those districts like the Murray, which are warm and dry, yields a paying crop.

Good Ferments

Are another factor of good wine, and after all the light thrown on this obscure question of alcoholic fermentation of late, the wine-maker has no longer any excuse for abandoning the fermenting vats to the capricious invasion of any particular ferments or germs that choose to invade it and take upon themselves the task of splitting up the grape sugar in the must into spirit and other products excreted from their microscopic bodies.

Although wine-making dates much farther back in the history of civilization than either the more modern industries of brewing or distilling, yet, as regards the common sense practice of fermentation, the brewer and the distiller may be shown up as an example to imitate to the more antiquated wine-maker.

No vat freshly filled with mash is ever allowed to start fermenting of its own accord in a well-conducted brewery or distillery, and similarly in wine-making, it is to be hoped, this vintage will sound the death knell of so-called "spontaneous" fermentation in the cellars of our progressive wine-makers.

Before filling up the first vat or cask, a small amount of mother ferment or yeast should be on hand, and this is easily prepared.

A couple of days before vintage proper begins, some sound, ripe grapes should be picked, brought to the cellar, crushed, and partly stemmed, as on the stalks lay a large number of useful yeast cells, which are the active agents of fermentation.

The must is then pressed out, if "white" wine is the object in view, or left with the skins for the making of "red" wine; this must be placed in a clean cask, with the head taken off and left in some cool corner, at a temperature of 25° to 30°C. (76°–86°F.), where fermentation will soon set in. When the first bubbles of gas show that the process has manifested itself, no time should be lost in picking, crushing, and filling with grapes the larger fermenting vats, and as the process of filling goes on, a bucket full of that mother liquor in full fermentation is every now and again scattered over the mass of the freshly crushed grapes.

The objects of conducting wine fermentation may be said to be manifold, and especially in a hot country are often the means of warding off the possible invasion of acetic or lactic ferments.

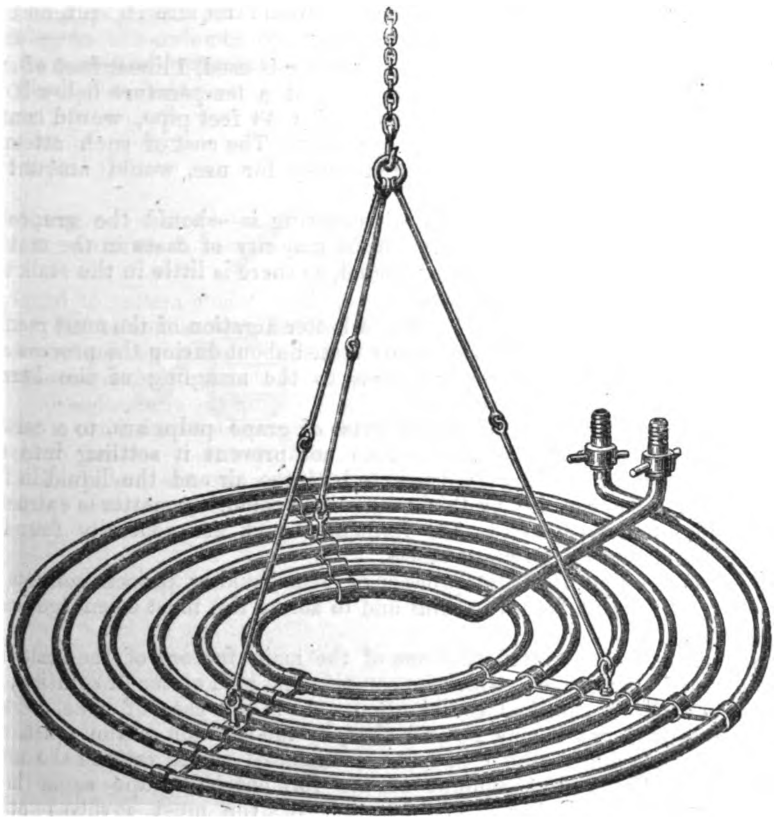
Of late years the deep clouds that shrouded the whole matter of fermentation have been dispelled by the progressive investigations conducted in the laboratory; that most inquisitive instrument the microscope has revealed the size and shape of the various organised bodies that are the active agents of fermentation, and the thermometer, supplementing the researches of the chemist, has defined to a nicety, the temperature at which each form of these micro-organisms found in crushed grape-juice thrive best, so that by controlling the temperature you are enabled to favour the one and check the other. Thus it has been found that the most suitable temperature for fermenting wine lies between 70° to 90°F. (21° to 33°C.). In the vinegar factory the temperature most suitable for turning alcohol into vinegar extends between 80° to 100°F. (26° to 38°C.), and the wholesale druggist who has a large order for lactic acid, carefully maintains the temperature of his spirituous liquor to even a higher temperature, ranging between 100° to 110°F. (38° to 42°C.). Armed with these facts, the brewer or the wine maker must strive to check the excess of temperature in his vats, to conduct wine making on the road to fermentation without interruption, and in as short a space of time as possible, so as to round the dangerous corner where these highwaymen—acetic acid on the one side, lactic acid on the other—are both lurking in the dark, ready to annex the wholesome spirit drawn out of the grape sugar by alcoholic ferment, and thus rob the wine grower of hard-earned reward, and the consumer of the mild stimulant that will nerve his flagging spirits or brace up his worn-out system, or manifest its way out again in bubbles of good humour.

To this end the use of an attemporator is much to be recommended. This apparatus, of which several designs are used in breweries, butter factories, &c., is, in this instance, for regulating the temperature of liquids when undergoing fermentation, and consist of a continuous run of tinned copper-pipe.

The above is a very simple and convenient form of portable copper attemporator, consisting of a flat, circular coil to suit the shape of the vat, of tinned copper-pipes $\frac{1}{16}$ of an inch thick, and 1 in. to $1\frac{1}{4}$ in. outside diameter, with supporting stays and suspending rods, by which it may be hung in the vat at any desired height. The pipes are fitted with unions for connecting india-rubber hose for the supply of cooling water. When required to be

removed after fermentation for cleaning purposes it is readily hoisted up by pulley-blocks out of the vat. The pipes are set at a distance of about 4 inches between, so as to allow rapid and thorough cleaning.

Amongst other advantages, this attemporator is easy to construct cheap, can be fitted up anywhere, being simply hung on a beam on the top of any vat. It is by means of the pully blocks and a counterpoise hitched on at



g. 2.

the other end of the chain, set at any depth in the fermenting wine. A good depth, I have found, is about 6 inches below the surface, as it is well known that fermentation, and hence development of heat, is more active at the top of the vat than at the bottom. The liquid on being cooled has besides a tendency to sink, and thus maintain amongst the lower layer of the fermenting must, a moderate degree of temperature.

For the purpose of working the attemporator, an abundant supply of cool water is necessary, and this can be pumped to a tank placed at a higher level than the attemporator itself, from a well, an underground tank, or even a cool stream. By means of a tap fitted on the supplying overhead tank the flow of the cooling water can be regulated so as to maintain the suitable degree of temperature in the vat.

In practice, 3 to 4 square inches of surface piping are allowed per g
of liquor to be cooled. This would be, with water at from 65° to 7
Supposing an attemporator is required for an 800 gallon vat.
a vat would not receive more than about 600 gallons of grape must.
linear foot of copper pipe 1 inch outside diameter, would represen
square inches of cooling surface, reckoning that the circle bears to
diameter the proportion of 3 to 1. This would be sufficient for cooli
to 10 gallons of liquor; for 100 gallons we would require 10 feet, and
600 gallons, a coil of 60 feet of 1 inch piping.

Supposing a pipe of $1\frac{1}{4}$ inch outside diameter is used, 1 linear foot of
piping would maintain 14 gallons of must at a temperature below 9
with water, say, at 68° F., and a coil made of a 43 feet pipe, would co
the temperature of 600 gallons of grape must. The cost of such atte
rators, with all fittings complete and ready for use, would amoun
about £6 to £8.

The first question that arises in wine making is—should the grape
stalked previous to fermentation? In the majority of cases in the ma
of red wine stalking is to be recommended, as there is little in the stalk
enters into the compostion of wine.

By the operation of stalking besides, a better aeration of the must res
as the bunches of grapes are vigorously tossed about during the process
the skins being rent asunder, previous to the mangling of the be
between the rollers of the grape mill.

Stalks in a small proportion in the mass of grape pulps are, to a ce
degree beneficial, as they keep it porous and prevent it settling into
compact a body, thus giving facilities to both the air and the liquid in
mentation to penetrate it; by this means more colouring matter is extra
and renewed activity given to the ferments which are generally foun
greater abundance on the grape stalks.

We thus see that the first process of wine making proper consis
separating the stalks from the skins and to aërate the must as energeti
as possible.

Pasteur has demonstrated that one of the main factors of the mat
of the wine is the oxygen, which its constituents hold either in solutio
in a state of loose chemical combination. As in the case of wine, so
with grape juice, and it may be said that, by the aëration of the must,
process of maturing of the grape is consummated in the vat and the
enriched by the fullest amount of the fermentable grape sugar
susceptible of developing. The aëration of the must involves
phenomena besides, which will be lightly touched upon presently.

The second question that presents itself is—should the fermentatio
conducted in closed or in open vessels? The skins and caps kept imme
in the must, or left to float by their own buoyancy?

Under this heading will be considered the advisability of insuring:

1st.—A maceration of the skins sufficiently prolonged to effect in a
measure its beneficial effect in wine making, but not so lengthened
communicate to the wine a stalky or "earthy" taste.

2nd.—Complete alcoholic fermentation all through the mass of the
and at every point of the fermenting vat.

To these ends, the following simple method of treating the must t
turned into wine which I have seen attended with the best results, I
mend to the attention of wine growers.

The grape pulp is conveyed in the ordinary ways, provided in each individual cellar, from the grape mill to the fermenting vat, which can well be an open one and should not be too deep, but rather shallow, and in this hot climate, not too capacious, viz., from 400 to 600 gallons preferably.

During this operation of filling up, a stright tap about ¾ of an inch to 1 inch inside diameter, driven in the plug hole at the base of the vat is left open so that as the must and pulp fall from the grape mill, the liquid must is allowed to run out into a tub placed under the tap for the purpose of receiving it. In order to avoid clogging and obstruction at the tap by the pulp, it is a good practice to nail together two 6-inch boards about the

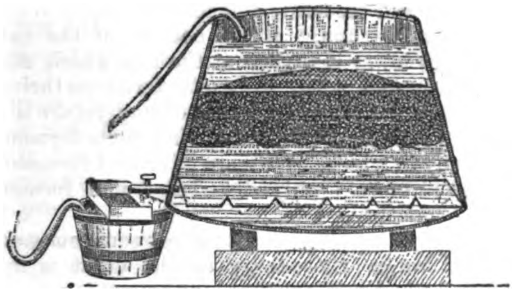


Fig. 3.

length of the bottom of the vat and V shaped. This sort of gutter is inverted with its edge uppermost from the top, across the diameter of the bottom of the vat. This will secure a free space for the must to drain from the pulp, and should the tap get clogged it can easily be removed, and a thin rod or a thick piece of wire poked through the plug hole along this V shaped gutter, so as to remove any possible obstruction.

This appliance is set fast at the bottom of the vat by means of a wedge driven in at the end diametrically opposite to the outlet or tap end. A few notches cut off its edges as well as the V shaped stays that help to keep the boards solidly together will allow the liquid to get underneath and run out through the tap into the tub provided for receiving it, while at the same time excluding the crushed berries and grape skins.

The liquid must in the tub is pumped provisionally into another empty vat or cask, and when the first vat is about one-third full of grape skins, the crushed grapes from the mill are directed towards some other empty vats. At this stage a man is sent down the vat last filled, to equalise the volume of the skins and fasten to hooks provided inside the vat and driven in at distances of 18 to 24 inches a strong net with ¾-inch meshes, so as to prevent the marc from floating and forming a cap on the top of the liquid in fermentation.

On this spongy mass of grapes freshly crushed are scattered a few bucketsful of must in full fermentation, from the tub set fermenting as already described, or from a vat already in fermentation.

Under the combined influence of the temperature of the fermenting house and on this crushed well-aërated mass, the newly added ferments soon take a hold of the contents of the vat, and within a very few hours fermentation

is in full swing. The liquid must collected separately is then pumped bac
the top of this spongy fermenting mass, and the conversion of grape
into wine thus sets it at once and goes on regularly and rapidly.

A few hours after the violent fermentation has set in, and instead of
old fashioned trampling down of the cap floating on the surface of the
in the vat, the plug at the bottom is knocked off and the fermenting
allowed to run through a strong sieve into a tub placed underneath. F
this tub the liquid is pumped back on to the top of the vat. Care shou
taken to screw the rose on to the suction hose, so as to ward against any
or pips getting into the valves of the pump and putting them out of ord

This pumping may be said to be attended with several results:—

1st.—It is one of the most practicable means we have in the wine c
of maintaining an even and moderate temperature inside the fermenting
The difference between the must at the bottom of the vat is someti
8 degrees to 10 degrees lower than that at the top, which often reaches
critical temperature at which acetic and lactic ferments thrive best. By
pouring it on the surface an even and moderate temperature is maintained,
the predominance of alcoholic ferments over injurious ferments thus insu

2nd.—The grape sugar, which, by a more advanced fermentation decre
at the top of the vat is more evenly distributed and fermentation goe
more briskly.

3rd.—In heavy must or must rich in nitrogenous compounds which
almost an element of danger, the energy of the yeast is increased by
process of aëration and the nitrogenous compounds precipitated by
action of the oxygen of the air on their elements.

For a vat of moderate dimensions, pumping for about half an hour
twice a day, will be found sufficient. By this means a complete circulatio
the must will take place in the vat, through the mass of emerged skins
marc, and the colouring matter thus steeped in a tepid liquid will be ea
washed off, and impart to the newly made wine the rich ruby colour wh
so much gladdens the eye of wine drinkers.

To sum up this improved method of wine fermentation it is seen that
period of fermentation is made as short as possible; the temperature is
allowed to rise beyond 92 degrees to 95 degrees F. Acetic and la
ferments have less chance of tainting the wine. Earthy tastes, often du
prolonged maceration of the marc in the wine, disappear; the colour of
wine is deeper; the process of fermentation being more rapid, fewer vats
answer for vintaging any given quantity of grapes as compared with
present system of fermenting, which means less capital invested in ferm
ing vessels; and most important of all a better type of wine will be tur
out, which will possess better keeping qualities, and when marketed comm
a better price.

On the Choice and Use of Artificial Manures.

By F. B. GUTHRIE.

Composition and Action of Manures.

We have now to consider the composition and the specific action of the several substances used as manures; and for this purpose it will be convenient to classify them according, as lime, phosphoric acid, nitrogen, or potash is their dominant constituent. The manures which depend for their action upon the presence of lime are burnt lime, carbonate of lime, and gypsum.

Burnt lime or quicklime is obtained by burning limestone (carbonate of lime) in kilns of special construction. Limestone is a compound containing lime and carbonic acid. In the process of burning or calcining, carbonic acid and water are driven off, and the burnt product is pure lime (calcium oxide) of greater or less purity according to the purity of the original stone. Other substances having the same composition as limestone also yield lime on being burnt such as chalk, marble, shells, &c. If the lime has been properly burnt it forms a very hard stony substance nearly white, which slakes, or combines with water, with great avidity, crumbling to a fine white powder and evolving sufficient heat to convert a part of the water into steam. In slaking it combines with water, and slaked lime is a hydrate of lime. As its function in the soil is principally mechanical, a test of its goodness lies in the readiness and completeness with which it slakes. Both under-burnt and over-burnt lime slake badly, though from different causes. The quantity to be applied to the soil varies according to the character of the soil. Unlike most of the manurial substances we shall have to consider, its action consists in improving the character of the soil rather than in acting as a direct plant-food. It is applied in quantities varying from half-a-ton to four tons per acre every six or seven years,—heavy clay lands requiring the larger dressing. It is best to break it up into small lumps, and place it in heaps about the field, covered with moist loam, leaving it exposed to the air and moisture for a short time—say about twenty-four hours—until it begins to crumble to powder. As soon as this happens, scatter the heaps with a shovel as evenly as possible over the surface of the field, and harrow or plough in lightly. Liming is most effectively done in the autumn or winter; but whenever it is done, the land should be left alone for quite three weeks after the application, and no seed should be sown, nor any nitrogenous manure added during that period.

The action of lime is in the first place a mechanical one, in altering the texture of the soil and with it those properties which depend upon its texture, such as its absorptive power for water, its amenability to tillage

operations, &c. If a small quantity of a heavy clay be mixed with wat any suitable vessel it will form a muddy liquid. If a little lime be a to this and the mixture well shaken, it will be noticed that the solid ma sink to the bottom in a loose powder, and, in a short space of time if the is poured off and the soil dried, it can be readily broken up by the fin This action, which is due to the power that the lime has of coagulating fine particles of the clay, is identical with what takes place on the la scale when lime is added to the field. The presence of lime also prevent shrinkage which wet clay-soils undergo on drying, and which causes cracks and fissures seen on the parched clay-soil. The admixture of lin a clay therefore prevents the formation of a sticky mass when wet, a cracked parched appearance when dry.

On light sandy soils the action of lime is also strikingly benefici binding the particles of sand together, and increasing the cohesive capillary power of the soil. Its action is in fact, exactly that of lime on in the mixing of mortars, only on a much modified scale, since for ma mortar the proportions are one part of lime to three or four parts of s whereas the addition of a ton of lime per acre represents one part of lim nearly 20,000 parts of sand. The action of the lime is the same in cases, on drying it absorbs carbonic acid from the air, forming carbona lime, which cements the particles of sand together, forming, in the proport used in making mortar, a hard compact mass, and in the case of the increasing its cohesiveness and its power of retaining water. Lime, there lessens the cohesiveness of clay soils, and increases that of sandy soils, properties which are apparently opposed to one another. In fact, there few soils, the mechanical texture of which is not improved by the addi of lime.

The action of slaked lime is exactly the same as that of stone, or qu lime but not so pronounced, and it is generally preferable to use the unslaked, or only slightly slaked, as recommended above. Apart from the a mechanical property of lime in improving the texture of the soil, it has a chemical action and though this is not thoroughly understood it ma classed under the following headings :—

First, it neutralises the free acids sometimes present in soils. Sour contain free acids present in such quantity as to be injurious to plant and such soils are "sweetened" by the application of lime, that is to say, free humic and similar acids are neutralised.

Secondly, it attacks the inert organic matters in the soil and prom fermentation, one of the most active agents in the production of avail plant-food. It is of course possible to have too much of a good thing, and a cessive dressing of lime would tend to burn up the vegetable matter of the and do as much harm as good, but in the moderate dressings above rec mended it will be found beneficial even on land which has lately been gr manured. It must not be forgotten also that the action due to caustic- soon ceases, for it is very rapidly converted into carbonate of lime within soil, which has no such action on organic matter. The danger therefore the addition of lime destroying the organic matter of the soil, is a bogey.

Thirdly, it attacks the insoluble mineral constituents of the soil to s extent. This is notably the case with potash, which being a weaker base t lime is set free from its insoluble compounds such as felspar, and rend available as plant-food. Phosphoric-acid also enters into combination lime, and is in this form more readily utilised by the plant than in its insol combinations with iron and alumina, with which it is associated in the so

Fourthly, carbonate of lime (into which we have seen the lime is soon converted in the soil) is beneficial, if not necessary to the process of nitrification, the peculiar ferment action by which the inert soil-nitrogen is converted into nitrates.

Fifthly, whilst it promotes certain ferment action such as the above, it hinders the active growth of many fungoid diseases like rust and smut, and is often a cure for such diseases.

Carbonate of lime, or as it is sometimes called "mild lime" is unburned limestone or shells crushed. Its addition to the soil promotes fermentation and nitrification, prevents clay lands from puddling, and in short has much the same action on the soil as lime has, except where such action depends upon the conversion of lime into carbonate. It is milder in its action, and as a rule, burnt lime is to be preferred.

Gypsum or plaster is also a substance that may be sometimes used to advantage. Its action consists almost solely in setting free potash, hence it is most useful on soils rich in potash, and for such crops as clover it is of especial service. It is best applied moist or in wet weather at the rate of 2 to 3 cwt. per acre. Gypsum is also often used as a "fixer," that is to say, when added to dung or urine or decaying animal and vegetable matter it decomposes the carbonate of ammonia which is being continually evolved from such substance and converts it into sulphate of ammonia, in which form ammonia does not escape into the air. If a heap of dung from which the odour of ammonia is perceptible be mixed with a few shovelsfull of moist gypsum, the smell will be found to have disappeared, in other words the ammonia is "fixed" and its loss prevented.

Manures Containing Phosphoric Acid.

Phosphoric acid is applied to the soil almost exclusively in the form of phosphate of lime, and its sources are bones, rock-phosphates, and guanos. In the apparent absence of any large quantities of phosphatic rocks in our continent, we are principally dependent for our supply of phosphate of lime on the bones of animals. Bones vary very slightly in composition from whatever source they are drawn, or from whatever part of the animal they are taken, though as a rule the thigh-bones and the bones that have to bear the greatest mechanical strain, are the richest in phosphate of lime. Bones are composed chemically of water, ossein or collagen, fat and mineral salts. The last-named, which are left behind as ash when the bones are burnt, consist principally of phosphate of lime. Bone-ash contains about 83 per cent. of this substance, together with about 10 per cent. carbonate of lime, and in much smaller quantities magnesium compounds, and fluoride and chloride of calcium.

The ossein of the bones is the substance which is converted into gelatine by boiling with water, and is an albumenoid containing about 16 per cent. nitrogen. Bones are therefore a nitrogenous as well as a phosphatic manure. An average sample reduced to powder as bone-meal, contains about 45 per cent. phosphate of lime, and a trifle under 4 per cent. nitrogen.

Bones are used in a variety of ways. They may be used whole, or broken, or reduced to powder (as bone-meal, bone-dust, or ground bones), they may be boiled, or steamed, or fermented; calcined (bone-ash), charred (bone-black), or converted into superphosphate.

We will now see how these different methods of treatment affect their composition and action.

When simply broken or crushed their chemical composition is, of course, unaltered, and the principal advantage derived from their finer mechanical condition is the greater rapidity of their action. Whole bones resist decomposition within the soil for a considerable length of time, and it is very doubtful if their use is in any sense economical. In fact, as the object of artificial manuring is to feed the crop rather than the soil, it is doubtful whether slow-acting manures are in any case economical. The case of lime, which we have just considered, stands on a different footing. Lime is seldom applied as a direct plant-food. Its action is practically confined to the soil. The substances we have now to consider are valuable only when they are available as plant-food; they produce little or no permanent benefit to the soil, and if their decomposition is slow the plant receives its nourishment in small driblets, inadequate to its needs.

Bones are therefore most efficacious when crushed, and within certain limits, the finer the powder the better the product as a manure. An additional advantage of fineness of division lies in the ease and evenness with which it can be distributed on the land, or mixed with other manures.

Bone-meal is decomposed in the earth, the nitrogen in the ossein being converted by putrefaction into ammonia, and the phosphate of lime rendered soluble by the action of carbonic acid and the vegetable acids. It is particularly suited to turnips and root-crops generally, grass, tobacco, fruit-trees, and in fact is a manure of almost universal application. It is applied at the rate of from 3 to 5 cwt. per acre, and if mixed with a manure containing potash, forms a complete manure, and is an excellent substitute for stable manure. It is more particularly adapted to light soils, and is sometimes disappointing on heavy clays, the probable reason for which is that in stiff clay soils it is more or less protected from putrefaction (which we have seen is the cause of its efficacy) by the absence of air and moisture.

Boiled or steamed bones or bone-meal.

When bones or bone-meal are boiled, and more effectually when they are subjected to steam, the ossein of the bone is gelatinized, and more or less removed, whilst the fat is also removed, the resulting compound being therefore poorer in nitrogen, but richer in phosphoric acid. The treatment renders them more friable, and they are easily reduced to fine powder. The removal of the fatty matter also renders them more easily decomposed in the soil, as fresh bones are more or less protected from external action by the presence of the fat. The proportion of phosphoric acid is therefore not only increased, but its rapidity of action and consequent effectiveness as a manure is increased, at the expense of course of the nitrogen, which may be reduced 1 or 2 per cent., as the accompanying table will show:—

Fermented Bones.

Bones may be decomposed and rendered more active by mixing them with about one-fourth of their weight of clay, and keeping the heap moist with stable-liquor or urine. The heap should be protected from rain. By this process also there is a loss of nitrogen, but the phosphate is rendered more readily available and proportionately increased. This is a method that deserves to be made use of where bones are plenty, and there is no means of reducing them to powder. Thirty to forty bushels per acre is the proportion recommended for grass lands.

Bone-ash.—The residue left after the calcination of bones consists, as we have seen, mainly of phosphate of lime, and contains no nitrogen. It is not largely used as a manure, its principal application being in the manufacture of superphosphate. It is dissolved in the soil by carbonic acid, and conveyed thus directly to the plant.

Bone-black is the product of charring bones. The broken bones are subjected to strong heat in closed iron cylinders, whereby they are converted into bone-charcoal, on exactly the same principle that wood is converted into wood-charcoal. The volatile matter of the bones is driven off in the form of gas, water, oil, and tar, and the carbon present is for the most part left mixed as charcoal with the mineral matter of the bones. This product is largely used by sugar-refiners for removing the colouring matter from raw syrups. After it has been used for this purpose a certain number of times, it becomes unserviceable, and can be obtained at a cheap rate for manurial purposes. It may be applied directly to the soil as a phosphatic manure, or better converted into superphosphate by treatment with acid. This substance is the basis of the manures manufactured by the Colonial Sugar Company.

Bone-black by itself is a purely phosphatic manure, containing only a very small proportion of nitrogen. The charcoal present has no fertilising value, and it is slightly poorer in phosphate of lime than bone-ash. It is, however, worthy of consideration as a manure on account of the low price at which it can be obtained.

The following table shows the alteration in composition which bones undergo when subjected to the above methods of treatment. The analyses are for the most part taken from Griffiths' work on manures, and are not analyses of the same sample, but represent fairly the composition of the several products. The analyses of bone-black was kindly supplied by Mr. Walton of the Sugar Company, and represents their "char," after it has been used for the purposes of refining.

	Bone-meal.	Boiled bones.	Steamed boned meal.	Fermented bones.	Bone-ash.	Fresh Bone-charcoal.	Spent Charcoal.
Water	10·43	10·61	11·57	12·02	1·86	......	2·
*Organic matter, including 10% carbon in the case of charcoal ...	32·30	21·55	19·01	28·71	.....	13·5	18·
Calcium phosphate ...	48·40	60·19	60·02	49·28	86·34	76·0	74·
Calcium carbonate alkalies, &c.	7·20	5·81	8·54	8·92	11·29	7·0	5·5
Insoluble	1·67	1·84	0·86	1·07	0·51	1·0	1·5
	100·	100·	100·	100·	100·	......	......
*Containing nitrogen ...	3·71	1·76	1·60	3·47	......	0·7	0·7

Chemical Notes.

BY F. B. GUTHRIE.

WOOD-ASHES AS A FERTILISER.

THE value of wood-ashes as a fertilising material is not as widely known it deserves to be. In newly-cleared country this valuable substance is p duced in large quantities, and it will be found to more than repay t trouble of returning to the land. It is a matter of common observation tl after a bush-fire the vegetation is particularly strong and luxurious, and t effect is due entirely to the lime, potash, and phosphoric acid thus return to the soil. The household fires also furnish a small but continual supp of ashes which should all be kept and made use of. They may be utilis either by themselves, or mixed with other manures, or added to the compo heap, a valuable adjunct to the economy of the farm.

The ash of the different woods contains the mineral portion of the wo from which it has been obtained. Of these ingredients the bodies possessi fertilising value are lime, potash, and phosphoric acids. Their potash a phosphoric acids are, moreover, in an exceedingly soluble condition, and in such state as to be readily assimilated by most plants. The value of t ash of the different varieties of European trees has been long well kno and their constitution established by numerous exact analyses. The co position of the ash of our own trees has not as yet been studied, but fr the following analyses made in the Department, it will be seen that they likely to be quite as valuable. I hope soon to be able to lay before you t results of a larger number.

	Phosphoric Acid.	Potash.
Spotted gum	·10	·69
Red gum	·38	4·17
Bloodwood	·80	1·50
Box...	·68	1·68
Blackbutt	·04	2·02

The analysis of blackbutt is due to Dr. Helms.

The process of burning converts the potash salts into carbonate of pota for the most part, the lime is present in the form of oxide and carbona and the phosphoric acid partly as calcium phosphate, and partly as alkali phosphates. Now carbonate of potash and alkaline phosphates are p ticularly soluble forms of potash and phosphoric acid respectively, t beneficial action of lime, both in the form of oxide (quicklime) and carbonate (chalk) is well known. It will, therefore, readily be seen wh

a valuable manurial substance we have got here. In addition to their direct action as plant-food, wood-ashes act beneficially in improving the quality of stiff clay-lands, and equally so in binding light sandy soils. In fact, they benefit the soil mechanically exactly in the same way that lime does. With the exception of nitrogen which, of course, has been burnt off, they contain all the ingredients of a complete manure, and in a particularly serviceable form. It might, therefore, be expected that the addition of a nitrogenous manure would make a complete manure of them. But such addition must be made with great caution, as the presence of free lime and alkalies in the wood-ashes are liable to decompose the nitrogen in such a mixture, driving it off in the form of ammonia, the smell of which will be apparent when sulphate of ammonium and wood-ashes are mixed together.

The ash of young wood is especially rich in potash, and generally speaking, the ash of young and small wood, as young boughs, twigs, &c., is more valuable than that obtained from the trunk or heart of an old tree.

The following are the best methods of utilising wood-ashes:—

They may be used alone as a top-dressing to grass and pasture, and for leguminous plants, but they are of benefit to nearly all crops, potatoes and roots, fruit and vines, being specially benefited. They are applied at the rate of from 25 to 30 bushels per acre.

A mixture of wood-ashes and bone-meal in the proportion of 5 cwt. bone-meal to 25 bushels ashes is said to be an excellent substitute for farmyard manure. Such a mixture should be made as it is required, and not kept mixed.

Instead of mixing superphosphate with loam or earth when applying it to the land, it may be advantageously mixed with three or four times its weight of wood-ashes. But the best way of utilising wood-ashes is the compost-heap.

The best material with which to compost it is undoubtedly peat, but other decayed or decaying vegetable matter is nearly as good, such as straw, old leaves, twigs, and refuse of this sort generally. Such substances are fermented by the action of wood-ashes and their nitrogen rendered available. The most convenient from of the compost-heap will vary on different farms, and the subject is so wide and important that it will be more properly discussed in a chapter to itself. On farms where the compost-heap is an institution, it should not be forgotten that the addition of wood-ashes forms the best method of utilising this product and improves the value of the compost-heap. Where such a system of utilization of waste matter is not practised, the following method of composting ashes will be found useful:—Make a heap of alternate layers of peat or peaty loam, or vegetable refuse and wood-ashes, or make a hole and fill it with these substances in alternate layers, moisten the heap with urine or slop-water, and allow to ferment for a few months, when it may be turned over. The addition of stable-manure, dung, and in fact all refuse-matter of the farm will benefit such a heap, which may be thus made the means of utilising a great deal of valuable fertilising material which would otherwise be thrown away.

The above remarks apply to unleached ashes, such as are obtained from the burning of timber.

Leached ashes contain practically little but lime and carbonate of lime, as the potash and phosphoric acid are for the most part leached out. Their use and action are similar to those described under the heading of carbonate of lime. They may be sometimes economically used instead of this substance, but in no case will the farmer derive any benefit from leaching his own ashes.

Australian Honey.

The following notes on the constitution of a few samples of comme honey and of honey obtained from well known apiaries may be foun interest to bee-keepers.

Of five samples of commercial honey examined, three were undoubt adulterated with starch, syrup—or glucose. The following table gives polarimeter readings and the percentage of glucose, water, and ash in el samples.

	Water.	Ash.	Direct Reading Sugar scale.	Reading after inversion.	Glucose by copper.	Glucose after
1. Commercial (adulterated)	20·0	·32	+65·12	+61·12	52	76
2. Commercial (adulterated)	21·33	·27	+14·32	+ 7·37	64	76
3. Commercial (adulterated)	19·50	·26	+130·3	+119·8	50	80
4. Commercial	21·0	·10	—26·6	— 28	74	
5. Commercial	26·18	·14	—11·7	— 12·1	69·4	
6. Honey from apiary of Mr. W. H. Moore (Singleton).	23·02	·21	—17	— 19·5	71·4	
7. Mr. Walker (Tenterfield), bees fed on white clover.	19·18	·06	— 9·1	— 15·6	71·02	
8. Mr. W. Abram (Beecroft), bees fed on mixed flowers.	25·29	·16	—23	— 23	72·46	
9. Mr. W. Abram (Beecroft), bees fed on orange blossom.	26·33	·20	—23	— 23	72·45	
10. Mr. A. E. Taylor (Cowra)... ...	23·23	·04	—24·2	— 27·3	73	
11. Mr. Worrell (Baulkham Hills) ...	24·34	·35	—20·8	— 21·6	68·6	

The polarimeter readings were always taken at the same temperature before and inversion and the temperature is taken into account in the percentage calculatio the second table.

At the risk of introducing technical terms I will briefly explain the bea of some of these observations. This will save time and trouble later on, will enable those who care to follow this work to understand future note the subject.

Honey consists principally of a mixture of two sugars, dextrose and levul A solution of dextrose observed in the polarimeter rotates the polarised ra the right, levulose to the left. Levulose, however, turns the ray nearly twic far to the left as dextrose does to the right, consequently a mixture contair equal parts of these sugars will exhibit a left-handed rotation, and this l

handed or levo-rotation will be observed if there is any considerable quantity of levulose present. Now, cane-sugar is also a somewhat doubtful constituent of honey. This substance is strongly dextro-rotatory; but after inversion, that is, after having been boiled with acids for a certain time, it is converted into a mixture of dextrose and levulose in nearly equal proportions, and becomes in consequence levo-rotatory. Hence, in comparing the figures in columns 3 and 4 in the above table, any increase in the angle towards the left is attributed to the inversion of cane-sugar, and any adulteration with cane-sugar may be detected by this means.

Our knowledge of the composition of honey is very unsatisfactory; but it is reasonable to suppose that it consists essentially of these two sugars, dextrose and levulose, together with a very variable proportion of cane-sugar, and of 1 to 4 per cent. of substances whose nature is unknown.

The most reliable observations of pure honey would seem to establish the fact that pure honey, except under exceptional circumstances, is levo-rotatory, and it will be seen that all the honeys in the above table of known origin are levo-rotatory. Now, the substances with which honey is most likely to be adulterated are starch-syrup or cane-sugar. Glucose obtained from starch exhibits a strong right-handed rotation, consisting as it does of maltose, and dextrin. Cane-sugar we have seen is also dextro-rotatory, consequently we may regard a honey exhibiting a strong right-handed rotation as having received the addition of one of these substances. One other technical point and I have done. The sugars, dextrose and levulose, have the power of reducing alkaline solutions of copper. This gives rise to the figures in column 5, which give the total percentages of these sugars. Maltose possesses this power to a less degree and dextrin not at all. After inversion for three hours at 100° C. (see column 6), dextrin and maltose are converted completely into dextrose, and hence the higher percentage of glucose in column 6 is due to the presence of dextrin and maltose.

If we now examine our table in the light of the above data, we notice that the first three honeys all show a strong dextro-rotatory reading. They all, moreover, yield a precipitate of dextrin on the addition of alcohol. The high-reading of No. 3 excludes the possibility of there being any levulose present. It is simply starch-syrup or American glucose, with a slight flavouring of honey. Nos. 1 and 2 probably contain genuine honey, together with a considerable addition of starch-syrup. The composition both of pure honey and of starch-syrup are so variable that it is not easy to state dogmatically the amount of such admixture which in the case of No. 1 is probably considerably over 20 per cent., and in No. 2 over 10 per cent.

The above facts suggest the probability that the bulk of the so-called honey in the market is largely adulterated, and it is to be hoped that the bee-keepers of New South Wales will be able to see their way to protect themselves against such practices.

The remaining honeys, Nos. 4 and 5, give the same readings as genuine honey, and there is no reason to doubt their genuineness. No. 5 has granulated (dextrose has crystallized out), which is an additional indication of its purity. No. 4 is somewhat more strongly levo-rotatory than the samples of genuine honey, but not strikingly so, and is not unlike Mr. Taylor's honey. If invert-sugar is used as an adulterant, the reading will be more strongly levo-rotatory; but as honey is to all intents an invert-sugar, the estimation of this substance would be a very difficult matter in the present state of our knowledge, provided the mixer were ordinarily judicious. The higher price of invert-sugar fortunately renders its use extremely unlikely.

The following table shows the approximate composition of the gen[...] honeys examined, including the two commercial samples, and are calcul[...] from the readings given above, on the assumption that honey consists ma[...] of dextrose and levulose, with cane-sugar.

Percentage composition of genuine honeys.

	Water at 110° C.	Ash.	Dextrose.	Levulose.	Cane-sugar.	Unkn[...]
No. 4	21·0	·10	36·2	38·4	1·03	3·[...]
No. 5	26·18	·14	39·0	30·4	?	4·[...]
No. 6	23·02	·29	37·0	34·4	1·8	3·[...]
No. 7	19·18	·06	39·12	31·9	4·8	4·[...]
No. 8	25·29	·16	36·15	36·3	0	2·[...]
No. 9	26·33	·20	36·16	36·3	0	1·[...]
No. 10	23·23	·04	34·6	38·4	2·3	1·[...]
No. 11	24·34	·35	33·5	34·1	?	7·[...]

None of these honeys gave any indication of dextrin by the test applied, and [...] were all granulated or have granulated on keeping. I have to express my indebtedne[...] Mr. Helms for the samples of genuine honey, obtained through the courtesy o[...] gentlemen named; and to Messrs. Walton and Steel, of the Colonial Sugar Ref[...] Company, for several useful hints as to working and calculation.

Report on the Administration of Diseased Animals and Meat Act.

THE Under Secretary for Finance and Trade,—

Board of Health Offices, Sydney, 6 December, 1893.

Sir,

I have the honor, by direction of the Board of Health, to submit herewith a report on the administration of the "Diseased Animals and Meat Act" for the year 31st March, 1893.

This Act was assented to by the Governor on the 16th March, 1892, but prior to that date the Board had caused to be made inspections of animals sent for sale at Sydney and various country markets, and a large number found to be diseased were promptly destroyed, the owners as a rule offering no objection. The Mayor of Sydney also took similar action in the interests of the public health.

In making the preliminary arrangements for administering the Act the Board determined to utilise as far as possible the services of officers then in the employment of the Government and of the different municipal councils, and to this end authorised, in accordance with the powers given them by the fifth section, Government Medical Officers, Inspectors of Stock, Municipal Inspectors, Police Inspectors of Slaughter-houses, and other police officials to inspect and seize animals under the Act. Thus some 700 inspectors were appointed throughout the Colony without additional cost.

It is, however, to be regretted that some of the Municipal Councils which were invited to submit the name of one of their officers for appointment failed, and in several instances absolutely refused, to do so. As the Act is a measure passed in the interests of the public, it is only reasonable to expect that municipal authorities would cheerfully assist the Board in safeguarding the health of their particular districts.

At the same time the full services of the Government Veterinarian (Mr. Edward Stanley, F.R.C.V.S.) which were formerly divided between the Health Department and the Stock Branch of the Mines Department, were secured for this Board—the only actually new appointment being that of a Veterinary Inspector (Mr. S. T. D. Symons, M.R.C.V.S.). In this way the expense of administering the Act has not exceeded the sum of £1,000 per annum.

Returns have been supplied by the various inspectors, and from the figures furnished it appears that the following animals have been seized and dealt with during the year under review :—

District.	Cattle.	Pigs.	Sheep.	Calves.	Rabbits.
Metropolitan	994	450	14	2	675
Country	936	57	9	......	......
Total	1,930	507	23	2	675

In addition to the above, portions of unwholesome, unsound, or diseased beef, mutton, veal, and pork carcases, and putrid bacon have been seized and condemned.

Prosecutions have also been instituted against persons for selling or consigning diseased animals, both in Sydney and the country districts, and in nearly every instance convictions have been obtained, and fines inflicted. A large number of diseased cattle, apparently ownerless, and found straying on public lands, highways, reserves, &c., have been seized and dealt with under the sixth section, and are included in the figures given in the foregoing return.

The veterinary officers of the Board have visited many parts of the Colony from time to time, and afforded valuable instruction to authorised persons as to their duties, and also have given simple directions for the detection of diseased beasts, but in all seizures the authorised persons acting therein have been directed to secure professional aid to support them, either from the local Government Medical Officer, or a competent and qualified veterinary surgeon.

During the year inquiries were made by European Governments, through the Secretary of State for the Colonies, as to the condition of the meat exported from this Colony, and in one instance a very large firm of London shippers instructed their agents in this city to procure certificates from veterinary inspectors as to the condition of the cargoes. This Board, however, with their limited staff, found it impossible, to make minute inspection of every frozen carcase leaving port, and, instead of this, furnished information to the Governments concerned respecting the Act now in operation for the prevention of slaughtering of diseased animals for food, and, on the assurance that the provisions of the Act were stringently administered by the Board, no similar requests have been subsequently made, and thus shippers are saved from a considerable expense, and the important export trade assisted, whilst the home consumer is protected.

Requests have been received from two Associations connected with the sale of stock in the city that all animals about to be sold at the various metropolitan markets should be inspected by the Board's officers prior to being offered for sale, in order that the sellers might be protected from committing possible breaches of the Act. The Board could not see their way to accede to these requests, it being no part of the duties of the Department to inspect stock previous to sale for the benefit of persons trafficking therein, and the Associations were informed that in the opinion of the Board such persons should take steps on their own behalf to prevent any infringement of the law, the departmental inspectors, however, attend

all sales regularly, and should any diseased cattle be presented for sale they are duly seized, but beyond this the administration of this very useful measure would be impeded.

Much opposition to the Act was displayed at its initiation by various persons connected with the breeding and sale of stock, and it was found necessary, in addition to the seizure and destruction of diseased animals, to institute proceedings for the recovery of penalties, in order that their responsibility in this matter might be brought home to graziers. As the provisions of the Act became more known it was realised that the trade generally would benefit by its strict enforcement, and that ultimately the flocks and herds of the Colony would be considerably improved. In no case, however, has the Board ordered any prosecution, except where the disease was external and clearly observable by any person with an ordinary knowledge of stock.

Applications have been made from time to time for permission to travel diseased stock to boiling-down works in various parts of the country; but the Board, whilst of the opinion that the boiling down of diseased animals was desirable, were not in a position to grant the necessary permits, as by the 6th section of the Act any diseased animals found in a public place, or on a highway, road, &c., are to seized and condemned. Further it appeared to the Board that to permit the travelling of diseased cattle to boiling-down works would be to expose to grave danger from contagion the herds of stockowners resident in the vicinity of the route taken.

The administration of the Act raised many points of scientific interest and pratical importance, to settle which it became necessary to undertake microscopical and experimental investigations, chiefly in the Board's laboratory. The results of much of this work are contained in the appendices to this report, and go far to show what diseases prevail amongst stock in this Colony, and to give an estimate of the proportion in which they affect the stock. It would thus appear that amongst 155 specimens collected indiscriminately from animals condemned as unfit for food, no less than 116 or 75 per cent., were found to be tuberculosis, thus at once justifying the action now being taken to prevent such animals passing into the food supply of the people.

The Board may be permitted to draw special attention to the investigations on the "Worm nests in beef" (App. 2) and on "Pants" or "heaves" a disease in pigs, one variety of which corresponds to "Coast cough" in cattle and consumption in man. But the investigation showed that there, was another and much more contagious variety due to a specific organism the recognition of which and the determination of its virulent character led to the disease due to it being placed on the list of contagious diseases under the Act. Coloured figures of the characteristic appearances are appended hereto. The organism—a bacterium—has been isolated and cultivated in a pure condition, and the experiments performed with the pure culture leave no doubt whatever that it is the cause of the more contagious variety of "pants." The losses occasioned by the ravages of this disease have been enormous, but it is hoped that the recognition of its nature and the prompt destruction of affected animals—the only remedy at present known—will lead to a great diminution in its prevalence.

I have, &c.,

EDMUND SAGER,

Secretary.

APPENDIX No. 1.

Re Microscopical examinations of Animal Diseases, by Mr. Pound.

Board of Health Offices, 127 Macquarie-street,
Sydney, 22nd May, 189

Sir,

I have the honor to report that during the three months Mr. Pound has b engaged on the above work, I have been able to secure 155 morbid specimens, taken fr from animals condemned as being unfit for food.

The specimens were collected indiscriminately, from the sale-yards, markets, abattoirs.

The results are very satisfactory, proving the correctness of diagnosis made by officers whose duty it is to condemn diseased animals or carcases, and also supports action being taken by the Board, under the Diseased Animals and Meat Act.

As I have taken great interest in watching Mr. Pounds work, and have examined ev preparation, I may be permitted to say much credit is due to him for his patient pers ance in determining, and demonstrating the specific micro-organisms ; it involved immense amount of labour, often from one to two dozen preparations had to be m from a single specimen before definite results could be obtained.

To the naked eye, a clinical comparison of the morbid specimens proved over and o again that to judge by histological appearances is most misleading and unreliable, as results of disease so closely simulate each other, although originating from very differ causes.

The following is a summary of the examinations :—

Diseases.	Cattle. Males.	Cattle. Females.	Swine.	Totals
	78	33		
Tubercle	111		5	116
Actinomycosis...	18		...	18
Abcesses	13		...	13
Cancerous	1		2	3
Dermoid	2		...	2
Pneumonia, contagious	...		3	3
				155

From the above table it will be seen that about 75 per cent. were cases of tuberculo and a large proportion were bullocks.

In 109 cases, Koch's bacilli were unmistakeably demonstrated. The diseased pa were sometimes pieces of lung, more often lymphatic glands in a nodular and case stage, and sometimes grapy tubercles from serous membranes.

Actinomycosis was usually in the maxillary region, one in the muscular tissue of tongue, one in a suppurating femoral abcess. Mycelium was much more frequently fo than clubs.

Of the abcesses, seven were acute, containing streptococci or other bacteria. The oth were chronic. These abscesses resembled tumours, were taken from the face, neck, brisk flank, lungs, kidneys, liver.

The cancerous cases were epithelioma from a cow's vulva. A sarcoma and a fibro from pigs neck. Two dermoid cysts from the necks of cattle, externally resembled tub cles (carcases were passed for food.) I attach a report by Mr. Pound.

I have, &c.,
EDWARD STANLEY, F.R.C.V.S.,
Government Veterinarian.

E. Sager, Esq., Secretary, Board of Health.

"Diseased Animals and Meat Act."

Board of Health Offices, 127 Macquarie-street,

Sir, Sydney, 22nd May, 1893.

I have the honor to submit to you a report which embodies the results of an investigation carried out in accordance with your instructions to determine the nature of various manifestations of diseases in animals condemned and destroyed under the above Act.

From 17th February to 16th May inclusively the Government Veterinarian secured specimens of diseased tissues and organs from 155 animals killed at the abattoirs and saleyards, such specimens being taken indiscriminately.

As soon as convenient after each animal was killed the morbid material was placed in a stoppered bottle containing 50 per cent. alcohol, with a label affixed bearing the date and necessary remarks.

Several specimens were obtained from different animals suffering from suppurating abscesses, a few on the flank. These flank abscesses, which are somewhat uncommon in cattle, bearing a striking resemblance to one another, so much so that it is almost impossible to diagnose them from their naked eye appearances. Their true nature can only be determined by resorting to various complicated processes of staining, and the use of the microscope with high power objectives. With these means at hand, I have been able to clearly differentiate these abscesses into three distinct varieties, viz. :—

Actinomycotic, in which the fungus appeared in the young active mycelium stage.

Tubercular, by the presence of tubercle bacilli, although very sparsely distributed.

And acute suppurating, which contained either the streptococcus pyogenes or the staphylococcus pyogenes aureus.

Taking any of these superficial abscesses from other parts of the body, if I failed to find either tubercle or actinomycosis. I was always successful in demonstrating the presence of some variety of pyogenic bacteria.

Very compact nodular growths are frequently noticed in the neighbourhood of the jaws in cattle; they vary considerably in size from that of a pin's head to an orange or even larger; in some cases they remain intact, while others have a tendency to break down and suppurate; they are situated sometimes in the subcutaneous tissue, frequently in and around the jawbones, but more rarely in the muscular tissue.

On examining six of these cases from the region of the upper and lower jaws, I found the actinomyces in nearly every stage represented in the life history of the organism, from the development of the spores to the actively-growing filaments, from the mycelium to the club-shaped bodies which ultimately undergo degeneration and calcification.

One specimen taken from the inferior maxilla of an ox consisted of a chain of little nodules, each of about the size of a pea, and firmly embedded in the muscular tissue. In structure they consisted of a dense mass of calcareous matter surrounded by a very thin wall of fibrous tissue. Failing to find anything of a tubercular nature, specimens were stained and examined for actinomycosis, but without success, although every known available method was used, and it was only when some of the calcareous material was treated with hydrochloric acid that I found a few clubs in a degenerative stage undergoing calcification. This manifestation of actinomycosis, which was undoubtedly undergoing spontaneous recovery, points out one of the many difficulties encountered diagnosing this disease.

It is interesting to note that two animals each having a tumour just under the skin in the region of the parotid gland, and which felt like and resembled tubercle or actinomycosis, proved after the animals were killed on final examination to be typical examples of dermoid cysts, otherwise these animals were in a perfectly normal condition, and, although they were not condemned, are sufficiently interesting to be noted.

I wish to draw attention to the fact that several cases of tuberculosis submitted for examination from the abattoirs were taken from dry milch cows. The specimens consisted of portions of the lungs, liver, and various lymphatic glands, and in each case presented the appearance of a chronic and long-standing form of the disease, the lungs and glands being a solid mass of caseating and gritty tubercular deposit, while tubercle bacilli wereextremely numerous.

A number of cases of bovine tubercle presented itself in the "grapy" or "perlsucht" form of the disease, while a few lung cases of tubercle in the early stage were found associated with the old lesions of pleuro-pneumonia.

By using the same staining reagents throughout of series of specimens under precisely the same conditions, I found that the tubercle bacilli varied very considerably in size and manner in which the stain was taken up. Some of the bacilli appeared very long and distinctly beaded, in others the beading was absent, others again were very short and fat, while some took the stain very readily, others were more resistant. In some specimens the bacilli were very numerous and frequently found in giant cells, while in others difficulty was experienced in even finding one or two in a dozen preparations.

Only one case of true bovine cancer was submitted for examination, that bein epithelioma from a cow's vagina.

On examining specimens from two pigs, one was found to be a "mixed cell sarcor the other a fibroma.

Specimens were secured from eight pigs suffering from lung disease; on examinat five of these were tuberculosis, while in the remainder, which were cases of contag pneumonia, I found the specific micro-organism.

In some specimens of tuberculosis in which the tubercle bacilli were not found ov to their sparse distribution, it was necessary to rely on the histological characters, this only occurred in seven cases out of 116.

TABLE showing results of microscopical examination.

Diseases.	Cattle.	Pigs.	——
Tuberculosis	....	....	116
(Histologically)	7	....	....
(Bacilli found)	109	5	....
Actinomycosis	....	....	18
Abcesses	....	....	13
(Histologically)	6	....	....
(Pyogenic organisms found)	7	....	....
Epithelioma...	1	....	1
Sarcoma	....	2	2
Contageous pneumonia	....	3	3
Dermoid cysts	2	....	2

Total number of cases 155

This investigation adds materially to our present knowledge of the nature of dise in cattle and pigs, also to what extent tuberculosis and actinomycosis is prevalent am cattle. Further, it points out how readily, in some instances, one disease may mistaken for another when judged by the microscopical appearances only, and when s diagnosis is unsatisfactory, only a microscopical examination can bring about the des result.

I have, &c.,

Edmund Sager, Esq., Secretary, Board of Health. C. J. POUNI

APPENDIX No. 2.

NODULAR TUMOURS.

Worm Nests in Beef.

Sir, Sydney, 3 March, 189

I have the honor to report having noticed small tumours, like marbles, on the brisl under the skin, and in the deeper layers of cellular tissue and fat, more commonly s in this region, but they are occasionally seen in other parts of the body, sometime numerous as to be mistaken for tubercular nodules. Butchers call them white kernels distinguishing them from the brown-coloured lymphatic glands.

On cutting them open they are found to be firm and whitish in colour, but in spring they are yellowish and drier and contain distinct calcareous worm casts. T rarely soften or excite suppuration.

They are made up of dense fibrous tissue, in which namatode (round) worms are in twined. I have only been able to extract pieces of the worms, and find they contain and also living little worms. Some of them are free, some coiled up in the ova ce They probably belong to the variety spiroptera. A similar parasite is found in nest the stomach of the horse.

These nodular tumours are not at all uncommon, and are possibly harmless to the m consumer. I have, however, advised the Meat Inspectors to have them cut out, as t are unpleasant to the sight, and may suggest other diseases to the uninitiated.

I forward a few specimens of the tumours in bottle marked D, in order that they m be examined and identified.

The following is Dr. Gibson's report on the specimens :—

"*Specimen D.*—Three tumours from brisket of a fat bullock from the Abatto February, 1892.—This is a very interesting, and, in my opinion, important specim

The tumours were rounded or ovoid in shape, the largest being about the size of a large bean. Sections of the largest showed a somewhat kidney-shaped outline, with a dense fibrous looking capsule, measuring about the $\frac{1}{13}$ of an inch in thickness. Passing in from this capsule were numerous trabeculæ, of varying thicknesses, which interlaced to form a meshwork, enclosing spaces of different shapes and sizes, which communicated freely with each other. These spaces were mostly empty in sections cut on the freezing microtome, but in some of them could be seen parts of the contained parasite, cut in various directions.

Microscopically.—Examining the outer margin of the fibrous capsule, one finds that it is ragged and ill-defined, showing that it had not been entirely isolated from the surrounding structures. The tissue of this capsule was composed of dense fibrous tissue in some places, and of fibro-cellular tissue in others. It was very abundantly supplied by blood-vessels, many of which were embryonic in character. Young nematode embryos, in large numbers, were seen in some parts of this capsule, some bent double, others coiled up in figure of 8 fashion, and others stretched full length. Some appeared to be in the channel of a small blood-vessel, ready to be carried along the general circulation. The structure of the trubeculæ was somewhat more cellular than that of the capsule, and the blood-vessels were more embryonic. Some of these blood-vessels were in very close relation to the enclosed spaces. Numerous nematode embryos occupied certain parts of the trabecular mesh-work.

The above-mentioned spaces were occupied by adult nematode worms. Unfortunately, I have been quite unable to procure a complete specimen of the adult worm, partly because of the hardening in absolute alcohol, and partly on account of the complex mesh-work surrounding the worm. Even very cautious efforts at pulling served to rupture the parasite, so that a very imperfect description can be given. The parasites were adult females, resembling in structure ordinary nematodes. The uterus contained fully-formed embryos, as well as ova in all stages of development. As may be seen on examining slide D2, which is part of an adult parasite, the embryos are in enormous numbers in the uterine cavity. Although I am unable to give proper measurements of the adult parasites, or even to state whether one, or more than one, is present in each of the three tumours. I have taken very careful measurements of the embryos. These latter average $\frac{1}{100}$ of an inch in length, and $\frac{1}{5000}$ of an inch in breadth. They have a slightly bulbous head, with a circular, discoid, cephalic extremity, whilst the tail is frequently curved, and invariably tapers to a fine point. There was no sac observed surrounding the embryos, such as has been described in the case of the embryos of *filaria sanguinis hominis*. The contents of these embryos were slightly granular, but there were no organs visible in the interior.

In my opinion, these tumours, containing the adult nematode worms, with their embryos, may be regarded as so-called "worm-nests," or "worm-knots," which are not unfrequently found in the lungs of sheep, and rabbits and oxen. The parasites which form these "worm-knots" are said to belong to the strongylidæ; but some species of *filaria* also form "worm-knots." In this case, although the adult parasites appeared to be encapsuled, it is important to remember that the embryos which had become free had, in some cases, gained access to the blood-vessels, and it is not too much to imagine that numbers of them were circulating in the blood-stream. Important questions present themselves for consideration in this connection, especially the question of the probability of human infection from eating the under-cooked meat of the animals so affected. The complete life-history of the *filaria sanguinis hominis* has not as yet, to my knowledge, been satisfactorily wrought out.

The measurements of the filaria-like embryos in this case 'do not correspond to those which Lewis gives as the average for *filaria sanguinis hominis*. He gives the average length as $\frac{1}{75}$ of an inch, and the breadth as $\frac{1}{3500}$ of an inch. But it must be remembered that his measurements were taken from embryos which were alive and circulating in the blood-stream, whilst those which I give were from embryos either recently escaped from their parent or actually present in the uterine cavity, and, therefore, more immature. Moreover, my specimens were hardened in absolute alcohol, which would cause a certain amount of shrinking. As regards the absence of the tubular sac surrounding the embryos in this specimen, too much weight must not be attached to that, because after death the *filaria sanguinis hominis* may occupy the entire length of the sac, and so render it invisible, or may be found contracted within the sac so as to leave the latter visible at one or both extremities.

Without being able to determine definitely the actual species of parasite present in this case, sufficient has been stated to warrant careful consideration as to the treatment of the flesh of animals affected with these so-called "worm-knots" or "worm-nests."

Dr. Gibson also read a paper on the subject at the Medical Congress in September, 1892. *See* the Transactions of the Third Session.

See slides D1 and D2, stained with picro-carmine.

As nodular parasitic diseases are sometimes mistaken for tuberculosis, it may be well point out that they are met with in various animals, and may be found in many parts the body, and are often due to migration of the worms from the digestive organs. Th are found in the stomach and bowels of horses, in the lungs and bowels of sheep, and known to butchers' assistants who prepare sausage-skins as knotty guts, and are discard in consequence, being useless, as they easily tear from brittleness.

I have seen clusters of the worm nodules so excite the nutrition of the parts as become the seat of tuberculosis, and have found the tubercle bacilli in such places, b such an occurrence is purely accidental, as it is well known that tubercle will eas become established in the seat of any injured tissue when the subject of the injury already in a tuberculosis condition.

It will, therefore, be apparent that worm nest or parasitic worm nodules should not mistaken for either tubercles or cancers.

I have, &c.,
EDWD. STANLEY,
Government Veterinarian.

APPENDIX No. 3.

Swine Diseases.

Tuberculosis and Contagious Pneumonia.

Board of Health Offices, 127, Macquarie-street,
Sydney, 18 February, 1893.

Sir,

I have the honor to submit a review of the investigations carried on to determi the nature of the disease in pigs known as "pants" or "heaves."

In a report dated 25th May, 1890, on a visit of inspection to the South Coast Distri where I had noticed the prevalence of tuberculosis in cattle, the Board of Health ins tuted an investigation in order to ascertain the prevalence and nature of "coast coug in that district, which proved, on microscopical examination, to be bovine tuberculo (*vide* report presented to Parliament on the 9th October, 1890.) I drew attention to t disease, locally known as "pants" or "heaves," which I saw in the swine piggeries attach to a slaughtering-place, and at two butter-factories.

Post-mortem examinations revealed the pathogenic aspects of tuberculosis in seve cases; in others the pathology was new and indefinite.

In order to investigate the subject, I arranged for a supply of diseased pigs. Th were kept at Rodd Island, and, in conjunction with Mons. Loir, a series of experime were carried out during the year 1891.

We obtained at different intervals twelve diseased pigs. The symptoms of illness w noted, *post-mortem* examinations made, and inoculations carried out on twelve guin pigs and seventeen rabbits.

On 16th June, 1891 (3,242), a preliminary report by Mons. Loir and myself expres uncertainty as to the existence of tuberculosis, and suggesting the idea of a disease due a specific bacillus.

On 5th December, 1891 (6,712), being dissatisfied with the progress of the investigatio I reported (See Appendix A) on a pig that had been ill and under observation fo month, the *post-mortem* examination giving pathogenic indications of tuberculos Specimens of the diseased parts were submitted by the Board of Health to Dr. Jo Gibson, of Windsor, for histological and microscopic examination.

On 12th January, 1892 (253), Dr. Gibson reported this case to be "tubercular bronc pneumonia," and he suggested inoculations, he not knowing that experiments had been progress for twelve months.

On 2nd April, 1892 (1,675), I reported on experiments. Mons. Loir having return to France about Christmas, I determined to inoculate bovine tubercle virus, in order compare the results with the disease "pants."

I experimented on two healthy pigs and two guinea-pigs, in every case being successf in producing tuberculosis.

The disease was confirmed by Mr. W. Scott, Veterinary Surgeon, 17th March, 18 (2,050), and by Dr. Gibson (see his report, dated 19th April, 1892).

On 9th February, 1892, I obtained specimens of disease lung and lymphatic glan having the pathological lesions of tubercle from pigs slaughtered and condemned at t Abattoirs. These were submitted to Dr. Gibson for examination; also specimens fr the tuberculous guinea-pigs.

From his report, dated 29th March, 1892 (2,330), he found tubercle in each case.

During the year 1892 I lost no opportunity of gaining information about the diseases swine, making *post-mortem* examinations, and collecting morbid specimens from vario

localities, thus securing valuable material for further examinations; and, finally, this year, the Board of Health has secured the services of Mr. Charles J. Pound, a practical bacteriological laboratory assistant. He has enabled me to confirm my original diagnosis of the disease "pants," that it is of a tuberculous nature, and in some cases identical with tuberculosis (coast cough) in cattle, and with phthisis or consumption in mankind.

We have also demonstrated that swine have another lung disease, with all the symptoms of "pants." This is much more fatal than tuberculosis, and may be named "contagious pneumonia of swine." It will be found fully described further on.

Mr. Pound has demonstrated, by histological preparations, tuberculosis in eleven cases, and successfully stained the bacilli in seven of these.

Contagious pneumonia he demonstrated in four cases, and the somewhat intractable bacteria are well illustrated in each.

The pneumonia specimens were obtained from different localities, namely, Enfield, Riverstone, and Jamberoo.

I have found both these diseases existing in the same herd, but I have not found the two diseases in the same pig.

History of the Diseases and their Distribution.

The disease "pants" has been known to swine dealers for the last thirty years. In 1889 I found contagious pneumonia at a piggery in the Mittagong district; it was very fatal, and *post-mortem* examination revealed no tubercles, but extensive consolidation of the lungs.

In 1890 I saw both diseases at milk-factories and slaughtering-places on the South Coast.

In 1892 the Bodalla Company lost 60 per cent. out of a herd of 222 Bega pigs from the "pants" (contagious pneumonia). Wet weather and travelling, perhaps, increased the mortality.

For Liverpool Asylum twenty-five pigs were purchased in May, 1892. Five days later, contagious pneumonia ("pants") broke out; deaths occurred twenty-four hours after being taken ill, others lingered for a week; altogether, seventeen died, and the rest were killed to prevent the spread of infection to the other piggeries.

During my inspection of the metropolitan slaughtering-places in 1892, I found a few pigs affected with pants, on ten out of twenty-five slaughtering-places. The butchers always viewed it as a calamity, and believed it to be a necessary evil and a loss incident to the trade, quite beyond their control. They stated that it was usually fatal, but a few recovered. According to their accounts, the losses are very variable, and uncertain. This is easily understood, now that we know they may have been affected with tuberculosis, which is a slow-going chronic disease, or they may have suffered from contagious pneumonia, a disease much more virulent, and speedily fatal.

I found both diseases in the large swine herds (where several hundreds of pigs are kept together at Riverstone and at Enfield; also in the Hunter River District at Aberdeen. Contagious pneumonia was introduced in April, 1892, to the extensive piggeries there, by a herd of two hundred and forty pigs sent in lots from Sydney. The majority of these died in two or three weeks. The disease spread to the old stock of pigs, but was less fatal; 50 per cent. died.

The losses were so heavy that at the Aberdeen works pig-farming has been found unprofitable, and has been discontinued.

In order to allay unnecessary alarm by this report of disease in swine, I may mention that the inspection of pork at the Abattoirs during last year was energetically carried out, with the result that while many pigs have been condemned as unfit for food, I wish it to be specially noted that on comparison the percentage of diseased pigs was only about half as high as that of cattle condemned, out of the total number of animals killed for food, as beef and pork.

Remedial Measures.

Now that the pathology of "pants" is known, and its virulent character understood, it is not difficult to deal with.

If contagious pneumonia breaks out, kill every panting and coughing pig at once; the first loss will be the least, so stamp it out.

If tuberculosis is in the herd, treat every panting and coughing pig the same, destroy them. A tuberculosis pig never completely recovers; he is a source of dangerous infection to his fellows; the disease is hereditary, contagious, and incurable; he is useless to breed, and is condemned as pork; therefore there is only one remedy—stamp out the disease. By keeping a few convalescents about the germs of the disease are disseminated, and the herd will never be sound. Burn or bury deeply the carcases.

Tuberculosis or Consumption in Pigs.

Pigs are more susceptible to tuberculosis than cattle; it is usually found where lar numbers of pigs are kept together; it is hereditary, and spreads by contagion, throu the expectorations during attacks of coughing; it is readily communicated by inoculatio and more often assumes a chronic than an acute form, so that it is often noticed that consumptive pig may continue coughing and panting for months, and even grow and g fat.

Tuberculosis is a nodular disease affecting the lungs, liver, glands, and internal organ it is specially noticeable by little granules, called miliary tubercles, on the serous me branes, in the lungs, and in the lymphatic glands. The miliary tubercles are ve numerous, and often coalesce, forming nodules and nodular masses. These nodules pre on the capillary blood vessels, so cut off nutrition, then caseation begins and absces form. These, in chronic cases, become cheesy, and even calcareous.

In swine (also in cattle) we find the glands of the throat particularly liable to under degeneration, and form tubercular purulent abscesses, full of creamy matter, which ve rarely escapes through the skin, in consequence of its density.

Symptoms of Tuberculosis.

These are subacute and intermittent, a chronic cough, that may last for weeks months, the pig growing and feeding while the disease is slowly progressing. Both t cough and panting breathing are easily excited by exertion. The appetite is not oft interfered with until the disease is firmly established. Then they cease to thrive, wa away, cough badly, have diarrhœa, sometimes paralysis, and then die.

Pathology of Tuberculosis.

The distribution and stage of development of the tubercular deposits will vary in eve case examined. Sometimes they are very numerous, and in others scarce, and may ev be found in one region or organ only.

Serous membrances lining the chest or the abdomen are frequently studded with gr and yellow miliary deposits.

Lungs are always affected, with either recently-developed miliary tubercles, sm suppurating nodules, or patches of consolidation, with points of abscesses, and occasi ally with pleurisy and adhesion.

Lymphatic glands—bronchial, maxillary, mesenteric, &c.—are much swollen, w characteristic irregular surfaces, from projecting nodules, in some glands breaking dow becoming purulent, caseous, or calcareous.

Spleen is rarely much affected, only a few scattered nodules being found.

Kidneys.—Tubercular deposits are rarely seen.

Liver.—Usually contains a few scattered nodules. These are frequently purulent. rare cases this organ is extensively tuberculous.

Cirrhosis is often seen in pigs.

Intestines.—These are sometimes adherent from subacute peritonitis, associated w advanced mesenteric tubercles. The mucous membrane is not often affected.

Koch's bacillus is demonstrated in swine tuberculosis, thus proving the true nature the disease.

The pathological histology is described in Dr. Gibson's report, dated 13th Janu 1891.

Contagious Pneumonia.

Symptoms.—These closely resemble tuberculosis, but this disease is much more ra in its progress, and spreads through the herd. The pigs are more suddenly and sever ill, and die in from two to twenty days after taking the infection, the death-rate be from 60 to 75 per cent.

As the disease is located in the lungs, the respiration is obstructed, causing the sh panting breathing, from which the name "pants" has been derived. There is a pain cough, fever, excessive thirst, loss of appetite, weakness, inability to move about, a finally, paralysis and death.

Pathology.

The microsopical appearance of the lungs at first sight resembles pulmonary tub culosis; the bronchial and other lymphatic glands, especially those of the cervical a maxillary region, are usually involved; both pleuritic and peritoneal adhesions a effusions accompany this disease. The lungs show extensive consolidation or carnifi tion. It commences in the apices, spreading throughout the smaller lobes; portions both lungs are usually affected, and in fatal cases it involves nearly the whole of b

lungs. There is more or less congestion in the sounder parts; the consolidated patches are somewhat nodular, carnified, and gelatinous, the margins being clearly defined, but with very broken irregular outlines, the carnified parts being made up of clusters of solid lobuli. These are mapped out, giving a typical appearance; in colour pale grayish or yellow where caseous, with here and there a few densely-congested deep-red hepatized lobules; the inter-lobular septa are distinct as gray lines, bearing a striking miniature resemblance to contagious pleuro-pneumonia in cattle.

There is a granular appearance (not unlike the miliary tubercles); these are the little points of abscesses occurring in the nodules which undergo caseous degeneration comparatively early in this disease, but the little nodules are not diffused throughout the lung tissue, as is seen in the miliary stage of tuberculosis.

The affected parts are often, but not always, pleuritic, with recent adhesions to the ribs, and some effusion of fibrinous lymph. On section the lobules are seen distinctly marked out by the thickened septa; some are congested; many are solid, with infiltrated lymph; others are caseous; on looking closely minute vomicæ are seen, and little abscesses are plentiful. On pressure, a mico-purulent material exudes, the small bronchial tubes are found obliterated, the larger bronchials are congested and full of frothy mucus.

The bronchial glands are much swollen, spongy, and soft, from accumulated lymph-cells; often undergoing caseous degeneration. The surfaces and contour of these glands are even and free from nodules, and, therefore, unlike tubercle.

The abdominal organs and serous membranes are free from granular or nodular growths.

Pathological Histology.

By the Gram method, with carmine, and very patient manipulation, Mr. Pound has succeeded in demonstrating myriads of bacteria, shaped like grains of rice, single, and in short chains and very minute , invading the lung tissues, and most numerous in the early stages of the disease processes.

These bacteria are probably the *materiesmorbi* of this disease, and their presence accounts for the army of leucocytes surrounding the nodules; the bacteria are very plentiful in the centre of the nodules, especially where they are becoming purulent (they resemble Fraenkel's pneumo-cocus). He also found the pus organism streptococcus pyogenes, and apparently also other organisms.

Sections stained show extensive areas of consolidation, due to excessive cell proliferation, accumulations of leucocytes, which readily retain carmine dye; whereas tubercle lung, examined by the same method, at the same time, similar cells, stain faintly, and are so pale as to be almost indistinct. These cells are in dense masses, invading the alveoli, dilating them, and by pressure reducing the walls, which are much atrophied and indistinct; these alveolar walls are very clearly seen in tubercle.

The interlobular septa are much thickened by increase of fibrous tissue. The lucocytes appear to squeeze the little bronchi out of shape, invade the submucous membrane, break up and destroy the calumnar epithelium and crowd into the tubes and air vesicles.

Hœmorrhagic spots are well seen on the margins of the nodules. Vomicæ and minute abscesses are more frequent than in tubercle, and no centres of calcification nor any tubercle bacilli were found in the sections submitted to the Ziehl-Neelsen method of staining.

The lymphatic glands presented only slight changes, as cell proliferation, and it is interesting to note that no organisms were detected either by the Gram or by the Ziehl-Neelsen methods, whereas in the tubercular glands the tubercle bacilli were clearly defined.

The conclusion that the disease is contagious is founded on the history of outbreaks recorded, its rapidity of progress, 'and large mortality. It will be necessary to attempt the cultivation of the specific organisms and to inoculate subjects in order to place the matter beyond dispute. This, I anticipate, the Board of Health will sanction, in order to complete the subject. [This has since been accomplished.]

As a result of the investigations it is satisfactory to be able to state definitely that "pants in swine" is known to be two distinct diseases, tuberculosis and contagious pneumonia.

I would suggest that this disease, "contagious pneumonia in swine" be added to those schedules under the Diseases in Animals and Meat Acts, otherwise difficulty may arise in dealing with tuberculous swine or pigs with "pants."

I have, &c.,

EDWD. STANLEY, F.R.C.V.S.
Government Veterinarian.

E. Sager, Esq., Secretary, Board of Health.

Appendix A.

Re Swine Diseases.

Sir, Rodd Island, 16 June, 189

We have the honor of submitting this preliminary report of our experim to determine the nature of a disease in swine known as the pants.

So far as regards the *post-mortem* appearances of the pigs we apparently find alw the same disease. By microscopical examination in a few cases we found bacilli wh by their staining reactions, are very similar to those of tuberculosis.

Besides this we nearly always find another small bacilus. By inoculation of ani and cultivation in artificial media, we have not had tuberculosis, but nearly always same bacillus which is easy to cultivate.

A pig ill with the disease and a healthy one were at the same time inoculated Koch's tuberculine 0·01 c.c. each. They did not show any increase of temperatur any symptom of illness whatever during the thirty hours following the inoculation, quantity injected in each case being the same as will cause reaction in a man affe with tuberculosis.

We have, &c.,

A. LOIR.

To the Secretary, Board of Health. EDWD. STANLEY, G.

Appendix B.

Swine Disease—Experiments at Rodd Island.

Sir, Department of Mines, 5 December, 189

I have the honor to report that yesterday we killed a pig (naturally) suffe with the disease.

He was from three to four months old, in good condition, had a frequent cough, panting breathing; he has been under observation a month, the disease making little progress; he fed well, and was growing.

Post-mortem.—Sub-maxillary lymphatic glands much swollen, and becoming case the gland structure being infiltrated with pus. The lungs, especially the smaller lo were carnified and studded with nodules and abscesses. The body of the large l was thickly studded by grey, small, tubercular-like nodules, but under the se membrane.

The intestines were healthy, but the mesenteric glands were all more or less disea

The liver had characteristic gray patches, five or six from ½ inch to 1 inch in diame the tissue beneath being hard and infiltrated with blood. Spleen and kidneys w healthy.

I send herewith specimens of the diseased parts, hoping the Board will have th examined by a pathological histologist.

I am not at all satisfied with our knowledge of this disease up to the present ti M. Loir thinks it is a specific swine disease, due to a special microbe, but the microb intractable and uncertain. Even inoculation experiments give varying results, so t they cannot be relied upon.

The disease is not very fatal, and many affected will live, feed, and grow fat. I very slow in progress when the animals are cared for, but if exposed and ill-fed they sooner.

As to its being contagious, there can be no doubt; the majority appear to esc infection, but this would depend on local circumstances.

We intend to inoculate some healthy swine with bovine tubercle, and then comp the two diseased conditions.

With morbid specimens, sub-maxy, and mesenter glands; portion of liver; port of lungs.

I have, &c.,

The Secretary, Board of Health. EDWD. STANLE

APPENDIX C.

ᴘᴏʀᴛ on specimens of lung, liver, sub-maxillary, and mesenteric glands from a pig killed at Rodd Island, 4th December, 1891, suffering from the disease known as the "pants."

e specimens were all in spirit. They were treated in the ordinary manner, and cut her-freezing microtome.

Sections of Lung :—The changes were of a subacute nature, and consisted in areas ondensed lung tissue, varying in size from a millet seed, or even smaller, up to les almost as large as a small pea. The larger nodules were made up of a number aller ones, united together by catarrhal and a certain amount of interstitial pneu- a. Areas of commencing caseation, surrounded by a small amount of fibrous tissue, scattered through the larger nodules; and in some of the smaller nodules the same ge was seen.* There were a few giant cells, but these were, for the most part, ill- loped.

hen the nodules were sub-pleural the pleura was occasionally thickened over them, however, so markedly as it usually is in such cases. The smaller nodules were ently in relation to one of the smaller bronchioles; and one could see in transverse on the centre of the nodule occupied by the bronchiole filled with catarrhal products, surrounded by an area of small round cells, outside which there was frequently com- cing catarrhal pneumonia. Others of the miliary nodules were more directly in ion to the lymphatics of the lung, and these resembled somewhat closely the ordinary ry tubercle in the human lung.

ere was well-marked bronchitis, numbers of the bronchi being filled with pus cells catarrhal products which, in the case of many of the larger ones, became detached ng the processes of cutting and mounting.

veral of the pulmonary vessels were congested.

ctions were stained in Ziehl-Neelsen's stain, and according to the Ehrlich-Weigert od for tubercle bacilli. Typical tubercle bacilli were found, but very few in number irregularly scattered. Many of the miliary nodules contained one or more bacilli. e of the larger nodules were found to contain a few also; but very careful search was ired in order to detect them.

ther stains were used for the purpose of demonstrating ordinary bacilli. With the ption of a few micro-cocci, no definite micro-organisms apart from the tubercle bacilli e discovered.

he specimen is therefore one of tubercular broncho-pneumonia.

Sections of submaxillary gland.—Extensive calcareous change, involving a consider- portion of the section of the gland. Very little normal gland structure remaining, lace being taken by fibro-cellular tissue, in which were numerous giant cells often nged in groups in different parts of the section. Tubercle bacilli, varying very much ize, but quite typical, were present throughout the section. As a rule the bacilli were ted. In slide IIb, forwarded herewith, however, within the circle of ink which I e marked very imperfectly at one angle of the section, careful examination will reveal rge colony of tubercle bacilli arranged around a small blood vessel, and passing into neighbouring tissue. Some were in giant cells in other parts of the section.

Sections of mesenteric gland.—Changes very similar to those affecting the submax- y gland, and not requiring any separate description. Tubercle bacilli present in iderable numbers.

Sections of liver.—On examining with a naked eye, the cut surface of a piece of liver ch had been preserved in spirit, it was at once observed that one portion differed very siderably from the rest. It was fairly well defined and seemed darker in colour and e fibrous than the other part of the cut surface. Indeed, it resembled a portion of a hosed human liver with several localised apparently lobular-hæmorrhagic spots eradded. The microscopic appearances were of a complex nature.

t will be convenient to describe the changes in the diseased area under the following isions:—

st. *Changes in the fibrous tissue.*—As is well known, the lobules of the liver in the case he pig are completely surrounded by fibrous tissue, which is of course more abundant he so-called portal canals where it supports the branches of the vena portæ, hepatic

* Calcification was observed in one nodule in one section.

artery, and bile ducts. The individual lobules are therefore more sharply defined th is the case in the human liver. In this specimen there was very considerable increase the amount of the fibrous tissue : this increase being due to a fibro-cellular hyperpla with numerous small bile ducts embedded in it. The increase was not uniform through the diseased area, but was more marked in some places than in others. It involved merely the portal canals, but the interlobular fibrous tissue as well. The hyperplas tissue invaded some of the lobules as well as surrounded them, thus causing a grad involvement, and finally entire disappearance of the lobule, its place being taken by fibro-cellular tissue. So far the condition corresponds to what is known as ordinary coarse cirrhosis of the liver—localised. But careful examination of this new interstit tissue reveals in places the presence of minute rounded nodules consisting of small rou cells—tubercle follicles in an early stage. These follicles were comparatively few number.

Throughout the rest of the section the fibrous tissue was either quite normal, or most a little more cellular in places.

Changes in the blood vessels.—Many of the branches of the vena portæ were congest The walls of some of the branches of the hepatic artery seemed hypertrophied. T central or intralobular veins were dilated in the affected area, and the capillaries openi into them were likewise markedly dilated, and many of them were filled with blo The sublobular veins were also congested. But the most marked change was noted connection with some of the central lobular venous branches and the capillaries openi into them. The appearances varied from a small central lobular congestion of th vessels, with or without a minute capillary hæmorrhage, up to a condition in which t greater part of a lobule was occupied by a hæmorrhage. As a rule the hæmorrha started at the central part of the lobule, and was confined to the lobule in which it ori nated. Occasionally, however, one or two adjacent lobular hæmorrhages appeared to r together. The contents of the hæmorrhages differed in different cases, some consisting coagulated fibrin with very few blood corpuscles ; others of coloured and colourl corpuscles in normal proportions without fibrin filaments ; and others of both fibrin a corpuscles in varying proportions. Some had become transformed into masses of sm cells, with a delicate capsule of young fibrous tissue into small abscesses in fact. Arou many of these hæmorrhages there was observed an attempt at the formation of a fibr tissue capsule. The hæmorrhages varied in size and number, and were easily recogni by the naked eye.

Third changes in the liver cells and bile ducts.—In the affected lobules, the liver c were compressed and atrophied from pressure by the dilated capillaries. Where hæm rhages existed the liver cells were destroyed in the area occupied by the hæmorrha Some of the bile ducts showed evidence of slight catarrh.

It is possible that the hæmorrhagic changes above described may be the initial sta of an ordinary cavernous angeioma of the liver, but they do not exhibit the typi structure which we are wont to associate with angeiomata. Further specimens, in more advanced stage, are required for examination before this can be definitely settl At present, it is difficult to account for their presence in this specimen, except on t supposition that they are due to obstruction of some sort, in some of the branches of t hepatic veins.

Tubercle bacilli were found in some of the tubercle follicles previously described. sum up, there can be no doubt of the tubercular nature of the change in the lung, t submaxillary and mesenteric glands in this case. As regards inoculation experimen might I suggest that guinea-pigs be inoculated with large quantities of fresh mater from a recent case, and doubtless they would develop tuberculosis.

Windsor, 12th January, 1892. JOHN GIBSON, M.D.

Appendix D.

Tubercle in Swine.

Sir, Sydney 2 April, 1892.

In connection with the experiment being carried on at Rodd Island, I have t honor to report that I purchased, on 22nd November, 1891, three healthy store pigs, th about two months old ; they were kept under observation, and grew rapidly, and wi every indication of perfect health.

On 28th January I secured some bovine tubercle, crushed it into a pulp with distill water, and then injected a large quantity of the fluid (about 50 mims.) into the abdom of one pig, and subcutaneously the same quantity on the thigh of the other pig.

o. 3 pig was kept as a control.
he object of the experiment was to be able to compare the pathological lesions of erimentally induced tuberculosis with the swine disease called "pants."
rom the date of inoculation until death, both the pigs appeared to continue in good th; small tubercles formed at the seat of inoculation in each case; they did not ease in size after the fourth week; the pigs grew, and put on flesh and fat quite as dly as the control pig (all three lived together).
nere was no cough or increased breathing or any indication whatever of any sickness.
n 30th March, sixty-two days after inoculation, they were killed.
ne carcases were well nourished, and quite fat.

Post-mortem.

norax, no effusion in the cavities, or adhesions; both lungs were studded with gray ary tubercles, with here and there a yellow spot of degenerating tubercle; sub-iliary glands were caseous, much enlarged, and tuberculous; omentum, was normal very fat; spleen, excepting one suppurating nodule, was normal; kidneys, quite nal; liver, tunic healthy, several small abscesses underneath, like suppurating rcles; mesentary, normal; large intestine, gray miliary spots in the mucuous nbrane; peritoneum, normal, no serosity in abdominal cavity; glands, femoral, ric, submaxiliary, and mediastinal were invaded by caseous tubercles.
both pigs the lesions were very similar.
send sections of lung, liver, spleen, glands, and intestine in absolute alcohol for oscopic preparations if necessary.
nere was no carnification of the lungs, or serosity in cavities; two conditions very uently met with in the "pants."
ne control pig was killed and examined at the same time, and would seem to have racted the disease by cohabitation. Although only very slightly affected, there was rgement and commencing caseation of the submaxiliary gland, one caseous nodule in lungs, one in the liver, and one in the spleen; in every other part the organs were thy.
inoculated at the same time guinea-pigs Nos. 31 and 32; both became very tuberculous. cimens of their organs were sent to you on 3rd March in bottle marked C.

I have, &c.,

EDWD. STANLEY, F.R.C.V.S.,

he Secretary, Board of Health. Government Veterinarian.

APPENDIX E.

Subject:—"*Post-mortem* examination on guinea-pig at Rodd Island."

Sir, V. Barracks, 16 March, 1892.

I have the honor to inform you that I have this day visited Rodd Island, and made *st-mortem* examination on a guinea-pig, which died on the 14th instant.
he organs were more or less in a state of decomposition, which prevented a satisfactory mination.
he lungs were studded with minute yellow nodules, similar to those seen in bovine erculosis, only smaller.
light subcutaneous effusion existed in the seat of inoculation, inside of thigh.
one of the other organs presented any of the lesions peculiar to tuberculosis.

Yours, &c.,

the Secretary, Board of Health. WILLIAM SCOTT, M.R.C.V.S.

APPENDIX F.

Report on specimens received from the Board of Health, 5th March, 1892.

1. *Specimen A.*—Lymphatic gland from a pig condemned at the Abattoirs for tubercle, 9th February, 1892.

Sections of the gland exhibited extensive calcareous degeneration, which caused siderable damage to the edge of the razor. Microscopically, the greater part of the nd tissue was transformed into nodules of tubercle, varying in size, some of which had lesced to form larger nodules. The centre of most of the nodules was calcareous.

No giant cells were seen. Tubercle bacilli, in considerable numbers, were present near the margin of the nodules, and in the gland tissue generally. [*See* slides A1, hæmatoxyline stain, and A2, Ziehl-Neelsen stain.]

2. *Specimen B.*—Lymphatic gland from a pig condemned at the Abattoirs, 22nd February, 1892.

This specimen was also highly calcareous. The tubercle nodules resembled very closely those in specimen A, and do not require any separate description. Tubercle bacilli present in varying numbers, in the nodules, and in the lymphatic spaces throughout the gland. [*See* slides B1, hæmatoxyline stain, and B2 Ziehl-Neelsen stain.]

3. *Specimen C.*—Spleen, lymphatic glands, liver, and lung from a guinea-pig thirty days after inoculation with bovine tubercle pulp, 1st March, 1892.

(*a.*) *Spleen.*—Several nodules, scattered through the surface of the section, apparently in relation to the malpighian corpuscles of the spleen. Stained for tubercle bacilli. These nodules contained numbers of bacilli, arranged singly, and in rosette-shaped groups. Isolated tubercle bacilli were found scattered through the splenic pulp. [*See* slide C1, stained by Ziehl-Neelsen method.]

(*b.*) *Lymphatic Glands.*—Sections of these showed caseous centre, with caseous tubercular nodules outside. Tubercle bacilli in large numbers, and in all stages of development, were seen. [*See* slide C2, Ziehl-Neelsen stain.]

(*c.*) *Liver.*—A few minute nodules, composed chiefly of groups of small round cells and occupying for the most part the portal spaces of the liver were observed. These were evidently early tubercles, because in one or two there were attempts at giant cell formation, and tubercle bacilli were present, although few in number, and chiefly occupying the interior of the so-called "wandering" cell. [*See* slide C3.]

(*d.*) *Lung.*—In the piece of lung examined there was almost no appearance of tubercle formation proper. There was very considerable small cell-thickening of the inter-alveolar septa, and marked congestion of some of the pulmonary vessels, along with small hæmorrhages. In one or two places there were collections of small round cells, in all probability early tubercle follicle formation. Some of the bronchioles contained catarrhal products. Very few tubercle bacilli were found. [*See* slide C4, hematoxyline stain, and C5, Ziehl-Neelsen stain.]

Windsor, 29th March, 1892. JOHN GIBSON.

Report on Specimens received from the Board of Health, 5th April, 1892.

The Specimens were labelled, "Tubercle in swine, two months after inoculation with bovine tubercle 31/3/92." There were portions of lung, liver, spleen, glands, and large intestine.

Lung.

To the naked eye there were numbers of nodules, of firm consistence, scattered over the pleural surface of the lung, and, on section, the cut surface also contained nodules. These nodules varied considerably in size, some being about the size of ordinary miliary tubercles, others being larger. There was marked congestion of parts of the lung tissue. Under the microscope the larger nodules were seen to be formed by the union of two or more smaller ones, which latter were in turn made up of two or more so-called "tubercle follicles." Outside the larger nodules there was a variable amount of collapsed lung tissue, the seat of catarrhal pneumonia. Some of the nodules were calcareous in the centre. No typical "giant cells" were observed. Certain of the nodules were found along the line of the lymphatics, both pleural and peri-bronchial, &c. Very few bronchioles contained any catarrhal products, and the absence of marked bronchial catarrh constitutes the most important distinction between these sections and those from "pants," reported on 12th January last. This distinction, however, is doubtless due to the difference in the paths by which the tubercle bacilli gained access to the lung tissue. [*See* Report on "pants," 12th January.]

After staining with Ziehl-Neelsen's solution, tubercle bacilli were found, but not in large numbers, careful search being required to detect them.

See slide 1, stained by picro-carmine, in which near the apex a transvere section of one bronchiole may be seen filled with catarrhal products; and also slide 2, Ziehl-Neelsen stain, with tubercle bacilli.

Liver.

Slide 3 is intended to be used as a naked-eye specimen. It is mounted, unstained, in Canada balvam; and it will be noted that there are sections of two nodules at one angle of the preparation, these nodules being about the size of small peas. One is empty, the contents having dropped out; the other contains a caseous-looking material, which has been partly cleared up by the alcohol and oil of cloves used in mounting. The nodules are bounded by a delicate fibrous wall. Marked congestion of the branches of the vena portæ may easily be seen.

Microscopically.—Apart from the presence of the above-mentioned nodules, and the congestion of branches of the portal vein, very little of pathological importance was observed. The liver cells in proximity to the nodules were compressed and atrophied. Throughout the rest of the section they were granular and somewhat fatty. Some of the central hepatic venules were filled with blood. There was no increase in the interlobular connective tissue, nor any tubercle formation in the portal spaces in other parts of the section. In thin sections the greater part of the caseous contents of the above-mentioned nodules fell out during the processes of cutting and mounting. Here and there, however, small portions remain adherent to the wall. The wall itself consisted of fibrous tissue, and in some of the preparations sections of bile ducts and hepatic vessels were found in it, showing that the nodules had originated in the portal spaces. A few tubercle bacilli were observed in the caseous parts. It seemed as if the tubercle bacilli had been carried along the portal vein, and had set up a tubercular change in the walls of two of its branches, resulting in the formation of two tubercular abscesses. [*See* slides 4 and 5, the latter stained with Ziehl-Neelsen's solution for tubercle bacilli.]

Spleen.

In the spleen there was one caseous nodule, similar in size and appearance to those in the liver. One or two small tubercle follicles were scattered through the section. The malpighian corpuscles were prominent, and in several of them granules of golden-yellow pigment were present. Very few tubercle bacilli could be seen. [*See* slide 6, from near the margin of the large caseous nodule, stained with Ziehl-Neelsen's solution.]

Lymphatic Glands.

There were two sets of glands, but one description will serve for both, as the changes were almost exactly the same in each. The glands were highly tubercular. The central part of several of the tubercular nodules was calcareous. One or two attempts at "giant cell" formation were noted. Tubercle bacilli were found chiefly in proximity to the calcareous portions. In some parts they were fairly numerous; in others almost none were to be seen. [*See* slides 7, Ziehl-Neelsen stain, and 8, picro-carmine stain.]

Large Intestine.

A few small follicular ulcers were observed. There were increased numbers of small round cells between lielerküline's crypts, and the ordinary lymphoid nodules present in the submucous coat appeared more cellular than normal. I stained for tubercle bacilli, but failed to discover any. Slide 9, stained with hæmatoxyline, shows the follicular small, cell proliferation, and two lymphoid nodules.

Windsor, 19th April, 1892. JOHN GIBSON, M.D.

Board of Health Office, 127, Macquarie-street,
Sir, Sydney, 15 June, 1892.

I have the honor of submitting this summary of the experiments carried on in order to ascertain the nature of the disease known as pants or heaves in swine.

Several diseased pigs were procured from the coast district; at various times, six of these were killed, and *post-mortem* examination were made by M. Loir and myself; in each case he made cover-glass preparations from the diseased parts, and carefully examined them for the bacillus of tubercle; in only two cases he considered he was successful, these were on May 25th, the other on December 4th. Diseased portions from the last pig were sent to Dr. Gibson, and he reported finding tubercle bacilli in prepared sections. [*See* his report, 253, 1892.]

To assist the investigation a total number of nine guinea pigs and sixteen rabbits we inoculated with pulp juice, obtained by crushing pieces of the diseased glands or lun in sterilized broth or distilled water, with the result that not one single animal develop tubercles, all of them died very early, *i.e.*, within a very few days, not carly enough f septicæmia, but too early for tubercles to develop.

M. Loir attributed the deaths to a special microbe, as the prevailing *post-mort* appearances were serosities in large quantities in the serous cavaties. M. Loir left t Colonies to visit Europe about Christmas. Not feeling satisfied with the results so obtained, I determined to inoculate two healthy pigs and two healthy guinea pigs w bovine tubercular virus, so as to study and compare the microscopical appearances.

I procured bovine material "perlschut" from the abattoirs and inoculate them. Th all developed general tuberculosis (see report 1,675/92), with which specimens of diseas parts were furnished for Dr. Gibson's examination. His report of April 5 confirmed t nature of the disease. Tubercles were distinctly developed in several organs, and other points bore no resemblance to the diseased pants.

Subsequently a pig was condemned at the abattoirs with the maxiliary glands i tuberculous condition. Pieces were pulped with distilled water, with which I inocula two guinea pigs and three rabbits. The rabbits all died the next day; one guinea died eight days latter. Mr. Scott, V.S., made a *post-mortem* examination, and repor tubercular deposits in various organs. The other guinea pig lived on, slowly develop tuberculosis, and was killed seventy days after inoculation; *post-mortem* revealed gene tuberculosis. I send herewith pieces of the lung and gland for Dr. Gibson's examinat as these are the first and only cases of producing tuberculosis by inoculation with sw virus.

I am of opinion that the swine have two distinct diseases—one tuberculosis, the ot being a specific form of catarrhal pneumonia, often associated with pleurisy. I am c firmed in this opinion by the results of the inoculations, and by having quite recen discovered very minute bacteria in immense numbers in the lung tissue of a pig I l killed at Riverstone suffering from pants.

This microbe may by cultivation, &c., prove to be Fraenkel's pneumo-coccus, or it m be the specific microbe of this disease.

I have no doubt tuberculosis exists in swine, but up to the present proof is very sca but not less important.

The subject is of great interest, and I sincerely hope that arrangements may be mad continue the investigation.

I have, &c.,
EDWD. STANLEY, F.R.C.V.S.,
Government Veterinarian

E. Sager, Esq., Secretary, Board of Health.

Board of Health Offices, 127, Macquarie-street,
Sydney, 5 February, 1893

Sir,

I have the honor to report that Mr. Pound has completed the examination a preparation of microscopic specimens, from morbid specimens taken by me from sixte different pigs.

Mr. Pound has been most persevering and successful, finding the bacteria difficult stain. He has prepared over a hundred specimens, giving a complete histological insig into the diseases; and in five cases of contagious pneumonia—three from Enfield, t from Jamberoo—he has again demonstrated, what I think is the specific bacteria of t disease, in three out of five cases; the first time we found it in Riverstone pigs.

In eleven cases he has demonstrated tubercle histologically, and in seven the bacil of tubercle is found.

In no case was he able to find both the organisms in the same subject, proving that have two distinct diseases affecting the lungs and glands of swine—tuberculosis a contagious pneumonia.

would be interesting to try isolation and cultivation of the contagious pneumonia rium (as the experiments carried on by M. Loir failed to convey the disease by lation), in order to demonstrate the contagion.

I have, &c.,

EDWD. STANLEY, G.V.

ger, Esq., Secretary, Board of Health.

CONTAGIOUS PNEUMONIA IN SWINE—Concluding experiments.

Board of Health Offices, 127, Macquarie-street,
Sydney, 11 July, 1893.

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In connection with my report on this disease in swine, dated 18th February last, ein it was stated that the contagious pneumonia was probably due to a specific -organism, I have now the honor to report, that the organism has been isolated from ings of diseased pigs, and successfully cultivated by Mr. Pound, in the Board's atory, and carried through several generations.

e disease has been induced experimentally by inoculating healthy guinea-pigs, and ommon black-pigs of the Berkshire breed. The pathogenic results being identical the original disease, which has already been described in detail in my former report. a few animals have been experimented on, but with such satisfactory results that *ateries morbi* of the disease is clearly demonstrated.

order to explain briefly what has been done, I have appended two tables of experi- s, to which I beg to refer you. We found that guinea-pigs possess a considerable nity to the invasion of this disease. Of the seventeen experimented on, five were ne, eight were successfully inoculated, and four died under the operation. Whereas ght Berkshire pigs inoculated, every one took the disease, no matter at what point e body it was introduced, or what the state of the virus, *i.e.*, whether natural or ated artificially. The fever in them was very decided and fluctuating, the temper- ranged as high as 106° and 107° (the normal being 102·5°). The respirations increased ng from thirty-five to forty-five, the normal being ten or twelve per minute. In every the pathological changes were located in the thorax, and they were typical of gious pneumonia. In these experiments Kochs' postulates as to the microbic nature e disease have been strictly and completely carried out. The pigs lost flesh and d to grow, although feeding well all the time, and no doubt some would have regained lescence, although the pathological changes in the diseased parts of the lung tissues d prohibit complete recovery. The slow progress of the disease was, no doubt, favoured e liberal treatment and repose enjoyed by the animals while under observation. The ty observed in epidemics is, no doubt, increased by unfavourable circumstances, such d food, bad shelter, and the general ill-usage to which these animals are commonly cted. The experiments are by no means exhaustive. The question as to contagion subject to subject by feeding, or by cohabitation, or the susceptibility or immunity er animals to the contagion, have yet to be determined. And a disease similar to s said by German authorities to be communicable to birds, pigeons, and fowls. In Colony there are epidemic outbreaks of disease in poultry where pigs are kept, the e of which is unknown. These are interesting points that must remain unsolved e present. This disease, contagious pneumonia in swine, somewhat resembles the eineseuche, or German Swine Plague. It is quite possible that it is a modification t disease imported into the Colony several years ago.

w that the restrictions which wisely prohibited the importation of swine from foreign ries have been removed, and the ports of the colonies are thrown open, it is most that other contagious swine diseases will be introduced, such as have in the past re still causing immense losses both in Europe and America. It seems, therefore, able to have legislative power to deal with outbreaks of disease that already exist or may arise.

is disease, swine pneumonia, has since been scheduled as a disease under the Con- us Diseases in Animals Act.

r. Pound's report on his work with the micro-organism of this disease, which he has good enough to illustrate with sketches of the microbes, and also of the diseased s, I append hereto, and I have to thank him for the great interest he has taken in ging this investigation to a satisfactory conclusion.

I have, &c.,

EDWD. STANLEY, F.R.C.V.S.,

Government Veterinarian.

ger, Esq., Secretary, Board of Health.

No. 1.—TABLE to illustrate a series of experiments with disease of Swine, Contagious Pneumonia.

Guinea-pigs.	Date inoculated.	Where inoculated.	Source of virus.	Remarks.	Results.
	1893.				
A. Male ...	22 Feb. ...	Thorax	Lung exudate ...	....	Recovered.
B. " ...	22 " ...	"	Riverstone Pig ...	....	"
C. Female	22 " ...	Lung	" " ...	....	"
D. " ...	22 " ..	Abdomen ...	" " ..	....	"
E. Male ...	10 Mar....	" ...	Lung exudate; Camden pig.	Died in 7 days ...	Small clarnified patches in lungs; adhesive lymph serosity in abdomen.
F. Female	10 " ...	Thorax	" " ...	Died in 2 days ...	From operation; lungs inflamed.
G. Male ...	10 " ...	"	" " ...	Died same night ...	From operation; accidental lesions.
H. " ...	10 " ...	Lung	" " ...	Died in 5 days ...	Acute double pleurisy; lymph and servus effusion; carnified patches on lungs.
I. Female ..	21 April...	Thorax	Broth culture; 6th generation from the Camden pig.	Died same night ...	Accidental lesions.
J. Male ...	21 " ...	Left thigh ...	" " ...	Died in 9 days ...	Lungs partially carnified, and adhesive lymph filled the thorax.
K. " ...	21 " ...	Right thigh ...	" " ...	Killed on 10th day.	Recovering; no lesions in thorax.
L. " ...	21 " ...	Thorax	" " ...	Died same night ...	Accidental lesions.
M. " ...	30 " ...	Left thigh ...	Lung exudate from J.	....	Much swelling; lost flesh, then recovered.
M. " ...	14 May ...	Right thigh ...	Broth culture; 2nd generation from J.	Killed on 17th day	Both lungs much carnified; no effusion.
N. " ...	30 April...	Two inoculations the same as M and identical results.			
N. " ...	14 May ...				
O. Female.	14 " ...	Behind shoulder.	Broth culture; 2nd generation from J.	Killed on 17th day.	Patches of carnification in both lungs; no effusion.
P. Male ...	14 " ...	Thorax	" " ...	Died in 5 days ...	Both lungs carnified; adhesive lymph filled thorax and pericardium.
Q. Female	14 " ...	Left thigh ...	" " ...	Killed on 17th day.	Both lungs carnified patches, especially the right; no effusion.

No. 2.—TABLE to illustrate a series of experiments with the disease of Swine-Contagious Pneumonia.

Berkshire pigs.	Date inoculated.	Where inoculated.	Source of Virus.	Remarks.	Results.
	1893.				
1. Female.	6 May ...	Behind shoulder	Broth culture, 2nd generation from guinea pig J.	Killed on 24th day	Lungs carnified, anterior lobes, and mapped with congested lobules, with distinct septa; no effusion in thorax; bronchal glands swollen and gelatinous.
2. Male ...	19 „ ...	„	Broth lymph exudate from thorax guinea pig P.	Killed on 34th day	Lungs, anterior lobes, and part of larger lobes carnified; septa very distinct; solid parts degenerating; studded with miliary abscesses; no pleurisy; bronchal, thoracic and maxillary glands much swollen; caseous and calcareous spots.
		CONTROL.			
3. Female.	6 „ ...	Constantly cohabited with No. 1 and No. 2.		Killed on 49th day	Internal organs perfectly healthy, and pig in good condition.
4. Male ...	31 „ ...	Left thigh ...	Lung lymph from pig No. 1.	Killed on 18th day	Parts of both lungs, left extensively carnified; sub-maxillary glands much swollen and caseous infiltration.
5. Male ...	31 „ ...	Behind right shoulder.	„ „	„	Anterior lobes both lungs carnified, and both sub-maxillary glands much swollen and caseous infiltration.
6. Female.	31 „ ...	Thorax	„ „	„	Lungs several small areas of carnification; extensive pleurisy with yellow adhesive lymph, filling the thorax, also adhesive lymph over stomach, liver, and splen; bronchal and thoracic glands degenerating.
7. Male ...	31 „ ...	„ ...	„ „	„	Both lungs adherent and extensively carnified; lymphatic glands swollen and degenerating.
8. Male ...	31 „ ...	Thigh	Broth culture 10th generation.	„	Only very small carnified patches.
9. Female.	31 „ ...	Behind shoulder	„ „	„	Both anterior lobes carnified and spreading freely into right lung, and slightly into left; no effusion; glands swollen.

Board of Health Offices, 127, Macquarie-street,
Sydney, 12 July,

Sir,

I have the honor to submit to you a report on further observations i
Etiology of Contagious Pneumonia in Swine.

A pig on arrival from the Camden district at one of the metropolitan sale-yar found to be suffering from the disease, and was subsequently killed for experi purposes by the Government Veterinarian.

In the morbid tissues of this animal I was fortunate enough to not only ident specific micro-organisms microscopically, but succeeded in isolating and cultivatin artificially on various nutrient media.

The cultivations were carried on through several successive generations, from to agar agar, then to bouillon and back again to agar agar, and so on through a co able number of tubes, after which followed a series of experiments on guinea p swine, carried out with Mr. Stanley, in order to determine their virulen pathogenic nature.

While these experiments were in progress I took the opportunity of studying the morphological and biological characters of the organism.

The disease was transmissible to guinea pigs which were inoculated with th obtained from the lung of an infected pig, and the specific bacteria found on exam and again cultivated.

A cultivation of the tenth generation from a guinea pig was used for inoc healthy swine, all of which contracted the disease.

From every experimental animal that was killed or died after successful in ocu made inoculations on nutrient gelatine, agar agar, and broth ; but although the c were occasionally contaminated, I could always obtain a pure cultivation of the organism by the employment of the plate culture method.

No matter where an animal had been inoculated, either the thigh, shoulder, or thorax, the disease always became more or less confined to the lungs. The ante ventral lobes are first attacked, then the inflammatory process gradually proceed the principal lobes.

The naked eye appearances of the lungs in an acute case are shown in and ap drawing. The lobules in the ventral lobe have a decided livery aspect, wh principal lobe has a beautiful mapping out appearance, brought about by in thickening of the interlobular connective tissue, whereby the lobules, whic considerably in shade and colour, become very distinct. Occasionally a lobule ver consolidated and dark in colour is seen surrounded by apparently normal looking

In very advanced cases the bronchial, submaxillary, inguinal glands were enlarged, and in one or two cases were commencing to suppurate.

On cutting across the lungs in the acute stage a considerable quantity of sang frothy matter exuded from the bronchi, which in a more cqronic form of the dise replaced by a gelatinous muco-purulent matter.

In microscopic sections of the lung in the early stage we fined the alveo bronchioles greatly distended with inflammatory products, there is also f extravasation of blood, giving rise to hæmorrhagic infarcts, due to over-distention alveoli surrounding the blood vessels, with masses of leucocytes and fibrinous mat

The interlobular connective tissue is greatly thickened and filled with clear ly matter, which gives the mapping out appearance so frequently seen on post-m examination.

As the disease advances the bronchi become engorged with cells, which, w epithelium lining the walls, are seen to be in various stages of disintegration. Fre portions of the walls of the bronchi are so broken up that the contents are in communication to the surrounding tissues.

By making a series of microscopic sections of cover-glass preparations from d tissues in the acute stage, and staining after Leoffler's method, or by any of the dyes usually employed, it is frequently only with prolonged examination w immersion lense that one comes across even a few bacteria that can be regar presumably the specific forms, but, on introducing a scraping or a little of the ex from the aveolar tissue into a tube of agar agar or bouillon, their presence is inv detected after a few hours' incubation at 35° centigrade.

The reason they are so difficult to demonstrate in microscopic sections, apart fro sparse distribution throughout the tissues, is because they are like such organ glanders, typhoid and chicken cholera bacteria. Only a single stain can be used, f tissue and organisms, consequently they are almost obscured by their taking th only very faintly, while the tissue cells, especially the nuclei, stain intensely.

ronic forms of the disease other organisms are frequently met with, viz., the coccus pyogenes aureus, Streptococcus pyogenes, and other bacteria more or less genic nature.
uite evident that these septic organinisms play an important secondary part in ase by considerably hastening its progress.
presence in the air, soil, and water has been frequently confirmed by numerous , therefore, whenever they gain access to any suitable media they readily com- grow.
case of contagious pneumonia in swine certain tissues have been seriously im- the previous introduction of a specific bacterium. The general depression of of such morbid tissues render a nidus admirably suited to the requirements of genic organisms. Having once gained admittance and obtained a foothold in bulum provided with food moisture and a perfect incubating temperature, in rything favourable for the reproduction of their species, they immediately pro- r deleterious effects.
ir rapid multiplication and growth, accompanied by the formation of toxic products, duce morbid changes in the adjacent tissues characterised by caseation and These necrosed areas gradually increase in size until they coalesce and form cesses, which may break down and suppurate, ultimately giving rise to pleuritis carditis, which usually terminates in the death of the animal.
s from these necrosed parts of the lung, stained with alum carmine and Gram's present a very beautiful and instructive specimen both for high and low power s. The line of demarcation between the hepatized and necrosed parts are dis- rought out by a barrier of leucocytes, the nuclei of which are stained a much ed than other parts of the section, while the blue colour of the Gram's stain selects enic organisms which are seen in extraordinary large numbers scattered through- dead tissue. In cover-glass preparations stained by the same method, and l under an immersion lense, the micrococci are seen in chains and groups.
ations made from these necrosed areas show only very few of the specific s, more frequently none at all, while the pyogenic organisms are found in s numbers.
ason for the absence of pneumo-bacteria can only be accounted for by their being aërobic, viz., their inability to thrive without oxygen, of which in such morbid here can only be a very small amount. On the other hand the staphylococcus nd streptococcus pygenes are really facultative aërobic organisms, and, in conse- these dead tissues afford a nidus as well adapted to their requirements as the f an agar agar plate in the laboratory where they have free access to a plentiful f oxygen.

Morphology and Biology.

is a striking resemblance between the pneumo-bacteria in swine disease and the of chicken cholera, both in the appearance on cultivating media and in stained ions examined under the microscope, although by constant and careful observa- ave been able to detect several minute differences.
stain readily with any of the aniline colours usually employed, but for minute Kühne's carbolised methylene blue is to be preferred. They do not retain their hen treated by Gram's method.
n animal tissues and on various culture media they are found to vary very much In cover-glass preparations, stained with Kühne's blue, they appear mostly as rt rods with parallel sides and distinctly rounded ends. As a rule, the ex- s or poles of each individual rod are stained more deeply than the central portion, aries in size in different organisms. These clear spaces in some preparations d only under a moderate magnifying power might be easily mistaken for spores. they are more often twice as long as broad, but occasionally several are seen e length exceeds ten times the breadth. These filamentous forms stain very in some the colour is intense at one end, and gradually disappears at the other hers again may be uniformly stained, but only slightly, or may have a granular nce; the outlines of these larger organisms are also very irregular, which gives the their being involution forms. Being aërobic they naturally require a plentiful f oxygen; should, however, this be in any way limited, their growth is corres- ly retarded.
re is also necessary to keep up the vitality, for I find that cultures kept in the ry for several weeks, and allowed to become dry, could not be resuscitated on subcultures in fresh nutrient media.
kept several hanging drop cultivations under constant observation for some time us temperatures, but failed to recognise anything like endogenous spore forma-

Reproduction takes place by fission only; division takes place in a direction at angles to the longitudinal axis. Under favourable conditions a single rod will gr twice its normal length, then a constriction in the middle of this lengthened rod finally complete division whereby the two daughter cells become detached; somet however, this process of cell division is incomplete, hence one finds several rods together in the form of short chains.

They are non-motile, nothing beyond the Brownian movement can be observed examined iu the living condition suspended in drop of bouillon.

Cultivations in various stages of growth are quite inodorous, nor is there any p tible formation of gas.

The growth on 10 per cent. nutrient gelatine at 18°-20° centrigrade is very slow forms a delicate white or greyish layer, but does not cause liquifaction. Upon ge plates the colonies are first seen after several days, as small white points. examined under the microscope each colony has a light brown colour; the gradually increases until it attains the size of a hemp seed, having a decided sl convex surface and circumscribed margin. At this stage further development due, no doubt, to the nutrient media losing its moisture by evaporation.

Upon the surface of 2 per cent. nutrient agar agar after twenty-four hours incubat 35s C. the growth is very marked, forming an elevated mass, which, however, do spread far beyond the line of inoculation. In bouillon a slight cloudiness is fo which does not become very dense.

No appreciable growth takes place on potatoes. A peculiar feature is exhibi cultures of several days' growth on oblique gelatine when examined under the micr with a 24 m m objective and 12 com. oc. (see plate 9) running out at right angles needle track are extremely minute delicate striæ, which closely resemble the tr system in insects. This peculiar appearance has not been noted in cultures of the cl cholera bacterium or allied varieties.

An interesting point to be noted is the striking similarity between the specific organism in contagious pneumonia of swine and the bacteria which are associated such diseases as swine fever in England, swine plague in America, wildseuch schweineseuche in Germany, also rabbit septicæmia and chicken cholera.

Although the micro-organisms in these diseases have apparently the same m logical characters, considerable difference of opinion exists among the various obs who have directed special attention in studying their life history. Some regard th varities of a certain genus, while others are inclined to believe them as prac identical.

The slight individual differences observed under the microscope, and the vari noticed on cultivating media, may be attributed to the previous conditions of en ment in different species of animals, such as susceptibility, peculiarity of the soi variations in temperature.

In concluding this report, it must be admitted that our knowledge is still very i plete, but nevertheless, enough has been gained to enable us to judge what are the tial factors which come into play in the production of this disease. That the s pneumo-bacteria are absolutely necessary for the production of acute cont pneumonia in swine there can no longer be any doubt, but at the same time, as prev mentioned, considerable importance is attached to the presence and action of the py bacteria as secondary factors in the more chronic forms of the disease.

I have, &c.,

C. J. POU

Edmund Sager, Esq., Secretary, Board of Health.

Practical Vegetable Growing.

DIRECTIONS FOR THE MONTH OF JULY.

s one of the coldest months of the year in most parts of New South , and plant-growth is slow. Opportunity should be taken to dig up ·ound that may not be in use, so that it be exposed as much as e to the mellowing influence of frosts. This is a good time to prepare or the spring vegetables, so that it may be ready for early sowing and ıg. To attain success in vegetable growing it is necessary that the soil be thoroughly well dug and properly drained. The deeper the soil is e better provided the surface soil is kept on the surface as much as e. If the soil of the garden be not naturally rich it must be well ed with rotten farmyard manure, that is, the droppings of animals with straw or vegetable matter.

present article ends a twelvemonth series of directions for vegetable ıg, but in the future these articles will be revised and extended as as possible. It is satisfactory to the writer to know that they have he means of directing the attention of many to the important subject lucing home vegetables. It is often pitiable to see, about farms and 's homes, the absolute waste of good land where, with but little labour, nt vegetables can be grown with but little more work than sowing ds. But no attempt is made to produce even a simple herb, and if inaman does not come round, the family has to do without a vegetable. state of things is disgraceful in a country like this where every child ttend school. It is worthy of note that some of the Public school rs, to their great credit, teach many of the school children after the vork is over how to grow various kinds of plants. If this were a general e an immense amount of good would be done to the Colony, and it is much to hope that the Department of Public Instruction may see its the near future to require all teachers to pass an elementary training ticulture, so as to become qualified to teach the rudiments, at least, dening. It will be a great blessing for this country, when the its of agriculture, as well as of horticulture, are taught in the Public s. For all country schools this should form one of the most important ıs of the curriculum. And, doubtless, the time cannot be far distant t will be carried into effect.

aragus.—Preparation should be made for planting this useful and ome vegetable. There is no need to plant until next month, or even so long as the buds or shoots have not started into growth. But the l should be made ready without delay, and then the planting can be t leisure.

the ground at least 18 inches deep, or better still trench it 2 feet without turning the surface soil to the bottom of the trench. It may nted out that there is a certain danger in trenching a small portion of

a garden by itself unless provision be made to drain it thoroughly otherwise the part trenched will be apt to retain too much water and this will injure the plants unless the ground is naturally well drained. The fact is that the whole of the garden should be trenched before anything is sown or planted. If roots and stumps have been cleared away to a sufficient depth the work can be done sufficiently effectively by a subsoil plough, bear in mind, not a trench plough. But if the area set apart for a vegetable garden be small this work would have to be done before the ground is fenced in. Nothing, however, is so effective as spade work.

Artichoke Jerusalem.—Make preparations also for the planting of this vegetable. It will grow without much preparation, but the produce will be but small. The ground should be well dug, well drained, and well manured with rotten farmyard dung.

Beans French, or Kidney.—It may seem almost absurd to those who live in the cold districts to recommend the sowing of French beans, but there are some parts of the Colony where they will succeed even in midwinter, therefore, a few rows may be sown with good chances of success.

Beans Broad.—A few rows may be sown, if any more plants be required.

Broccoli.—Sow seed to as great an extent as you may need.

Cabbage.—A little seed may be sown in a seed bed or box. Sow in little drills 2 inches or so apart, and do not use too much seed. Try several kinds of seed to ascertain which variety succeeds best in your district. If you have any good strong seedlings, transplant them to some well manured ground that has been prepared for them.

Cardoon.—Is a vegetable worth testing for it is much liked by some persons. It belongs to the Globe Artichoke family and somewhat resembles that vegetable, but the tender leaves of the heart of the plants are eaten and not the flower buds as in the case of the artichoke. The seed is sown in spring and the seedlings are afterwards transplanted to well manured beds but this transplanting must be done very carefully or else the seedlings will die. It is the custom to sow seed in well manured trenches, like celery trenches, and when it comes up, to thin the plants out to about 18 inches or 2 feet apart. The plants need good supplies of water and rich soil. When they have attained a good size they will need earthing up like celery in order to blanch their hearts. Leaves or straw should be tied round each plant before earthing up so as to prevent any soil dropping in amongst the leaves.

Carrot.—Sow a little seed in drills about 1 foot to 18 inches apart. Thin out when the plants are large enough and keep quite free from weeds.

Cauliflower.—Sow a little seed to keep up a supply and plant out any strong young seedlings you may have on hand.

Cucumber.—In the warm coast climates sow a little seed in a sheltered position. It would be advisable to protect the bed at night with some bagging or other material, for fear of chance frosts or severe cold.

Capsicums or Chillies.—May be sown and protected as recommended for cucumbers.

Egg plants.—Seed may also be sown in the warm districts.

Leek.—Sow a little seed to keep up a supply. Plant out good strong young leeks to well manured trenches and keep them well watered if the weather and soil are dry.

tuce.—Sow a little seed-and plant out strong seedlings to well manured d.

ion.—Sow a good quantity of seed on well manured and well drained w beds where the seedlings can be weeded easily without treading gst the plants. Sow in drills and cover the seed very lightly with fine

snip.—Sow a little seed.

ns.—These may be sown largely in rows from 3 to 4 feet apart accord- the height of the variety. For the higher it is likely to grow, the wider the rows should be.

oy.—Sow a little seed in a seed bed. If any strong seedlings are avail- hey may be planted out. The soil should be well manured before ng.

nach.—Sow a little seed in drills 2 feet apart and thin out the plants they come up to about 1 foot from plant to plant.

de turnip.—Sow a little seed in drills

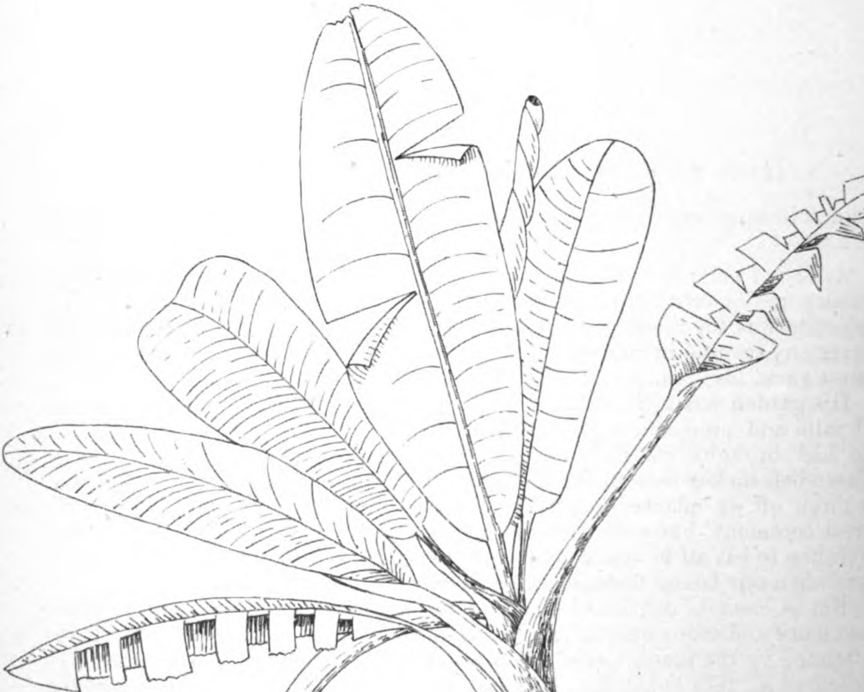
nato.—Seed may be sown in the warm climates, but protect at night.

nip.—Sow a little seed in drills.

Orchard Notes for July.

In a well cared for orchard July should be a busy month especially in Cumberland orchards, as there is the pruning of the summer fruit attend to. The planting out of new trees where old or dead trees have taken out and the setting out of new orchards in addition to the gather curing, and storing of the balance of the main crop of lemons, and gathering, packing, and selling of a large part of the orange crop. As orange-trees should always be well lightened during the month—as ear August the fruit often commences falling—every endeavour should be mad place the orange crop on the market in a satisfactory condition and to arra for the relief of our local markets by a judicious exportation of our surplus f This can only be accomplished by the fruit-growers combining and establ ing centrally-located packing houses which will turn out a straight grad goods that can be depended upon, and will export nothing that is not suit for the foreign market. The present method of individual export wit due regard to the grade, packing, and cases suitable for the foreign ma is the greatest mistake possible, as besides usually ending in loss to exporters it gives our fruit a bad reputation which can only be removed by maintenance of a standard grade under distinctive brands.

The cultivation of the orchard during the month will be confine ploughing, and if there is any slack time drains may be made where neces and all surface drains should be well attended to. In planting out yo trees always obtain yearlings—trim the roots carefully, and do not plant deep—always prune back hard at planting if you want a strong and w grown tree, and do not head too high, cutting back to knee high is a g general rule to go by. Never place any manure in the hole with the when planting. Where apple-trees are badly affected with woolly aphis should be well sprayed two or three times during the month with the r and soda wash, using a Nixon nozzle and applying the spray with all the f possible—winter sprays to destroy scale insects, red spider, &c., on decidu trees can be applied any time during the month.



(11659-94.)

PROTECTED BANANAS.

General Notes.

How to save Bananas from Flying Foxes.

The following interesting note has been forwarded to us by C. Hedley, F.L.S.:—

A former neighbour of mine on a Queensland selection grew bananas of a quality and quantity that raised his society in the estimation of us all. His selection was the most popular place in the district, for a time. It was never any trouble to ride over with his mail, to lend him a novel or tell the latest yarn, for a while.

His garden was a bit of hill scrub land, red stony soil, formerly a jungle of palm and pine, and it grew bananas to perfection. A few years before he had brought carefully in his portmanteau from Brisbane the first Cavendish sucker seen in the district. It throve, and each fresh sucker that it threw off was planted out. The first bunch that ripened was divided with great ceremony, but soon bananas became so plentiful that everyone was welcome to eat all he could and stuff his pockets full when he left. This was when our friend became such a favourite.

But as bananas continued to increase, production outgrew consumption, and more and more were left to waste in the garden. Then the flying foxes attracted by the scent, tasted the new fruit, approved of it, and presently devoured all they could find. At last even green bananas were destroyed and the owner had to gather his bunches unripe and hang them indoors to mature.

So the education of the flying fox resulted in fewer and worse bananas, which again diminished my friend's popularity.

Years afterwards in the interior of New Guinea, I learnt a trick to save bananas from flying foxes. As this simple plan of the savages may well be copied by Australian selectors, I have sketched a banana plant muffled in Papuan fashion and add the description from my note book.

A banana leaf torn in half down the centre is wrapped round the lowest "hand" of the bunch left hanging on the bough, the leaf midrib being tied round the stalk of the bunch; another half leaf is wrapped round the "hand" next above, leaving enough margin to lap well over beneath, and so on till the bunch be covered hand above hand. The whole then looks something like a huge unstripped maize cob. This shelter the flying foxes are unable to penetrate, and the fruit ripens as well bandaged up as open.

Worms in Fowls.

It would appear from a letter recently received from Mr. G. M. McKeown, of the Government Experimental Farm at Wollongbar, that fowls in that district are suffering in considerable numbers from intestinal worms. Three birds so affected were forwarded to the Department by that gentleman, and

have been subjected to examination by Dr. Cobb, the Departme Pathologist, who has made the following report which is reproduce order that it may be more fully circulated, and advantage taken of information it contains :—

REPORT.

THE fowls were examined for internal parasites, as no other cause of disease indicated.

(1.) The first one opened contained a single round worm of the sort known as *Het inflexa* (Rud), located in the small intestine; and several scores of the round- known as *Heterakis papillosa* (Bloch), located in the two blind-sacks attached t intestine. The single worm (*H. inflexa*) was about 2½ inches long. The smaller w (*H. papillosa*) were reddish, and about half-an-inch long.

(2.) The second fowl contained only *H. papillosa;* some hundreds of them present. Also, about a dozen tape-worms, probably belonging to the species *T proglottina* (Dav.)

(3.) The third fowl contained no parasites.

It appears to me that the worms seen by Mr. McKeown, and mentioned in his l are *H. inflexa*, which is the only species of round-worm or Nematode, which has far, been suspected of causing epizootics. I observed no signs of perforation su Mr. McKeown describes, and should feel greatly obliged if he could forward me spec that would show such perforations. Such a phenonemon, if verified by scientific e nation, would be a distinct addition to our knowledge of the diseases of the fowl.

REMEDIES.

(A.) The administration of pills made as follows, has been followed with good r in cases of epizootics apparently caused by *H. inflexa.*

1. Take equal parts root of Male Shield-fern, Tansy, Savory.
2. Make a decoction of this, using 10 oz. to three pints of water.
3. Take the liquor of the above decoction and make it into pills with flou administer them, forcibly if necessary.

(B.) I would advise Mr. McKeown, however, that prevention is much cheape cure, and that my experience is much in favour of the use of such measur follows:—

1. Remove the fowls to new land which has not received drainage from that on they acquired the disease.
2. If that cannot be done, make a whitewash, and sprinkle it copiously o ground used by the fowls; also, whitewash the houses and roosts.
3. The use of sulphate of iron with the lime or better still, following it, will advantage. Use as strong a solution of sulphate of iron as can be m water, and sprinkle it about.
4. The destruction of diseased fowls by fire is advisable.

MARKETING THE CHOCO.

AN officer of the Department who raised a fine crop of chocos at Pe Hills recently sent half a case (containing thirty-nine), to market with a neighbour's fruit. The half-case realized 2s. 6d., and the g received 2s. net. As the choco is very easy to grow, the roots shoot ou bear the second year, and, at present, the choco is practically unknow the market, this sale must be taken as very satisfactory, and there ap no doubt that in the future it will prove very profitable as a side cr the orchardist. If the soil is kept fairly loose the plant thrives in a soil with a clay subsoil, although a light, well drained soil will pro produce better results.

HAWKESBURY AGRICULTURAL COLLEGE.

E Principal desires it to be notified that there will be a few vacancies for
sident students next session, which commences on or about the 23rd July
xt, and that those desirous of competing at the coming preliminary
mination should make early application to the Department of Agricul-
e for forms of application and prospectus.

ENQUIRY INTO THE VALUE OF SPOTTED GUM FOR WOOD-PAVING.

E Minister for Mines and Agriculture has appointed a committee (con-
ing of Mr. T. S. Richards, City Surveyor; Mr. J. V. de Coque, Timber
pector, Public Works Department; and Mr. J. H. Maiden, Consulting
tanist to the Department of Agriculture), to inquire into the merits of
tted gum for wood-paving. Any persons who have evidence to offer to the
nmittee are requested to forward it to the Under Secretary as soon as
venient. Specimens of timber should be sent, when considered desirable,
elucidate evidence.

AGRICULTURAL SOCIETIES SHOWS, 1894

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindale	Jan. 9, 10.
Clunes Agricultural Society	J. W. Brown ...	,, 17, 18.
Albion Park A. and H. Association	T. Armstrong ...	,, 17, 18.
Kiama A. and H. Association	J. Somerville ...	,, 25, 26.
Holt-Sutherland H. and I. Society	W. Douglas ...	,, 26.
Wollongong A. and H. Association	A. J. A. Beatson...	,, 31, and
Berry A. and H. Society	A. J. Colley ...	Feb. 6, 7, 8
Gosford A. H. and I. Association...	H. S. Bevrendge...	,, 9, 10.
Luddenham A. and H. Association	K. Campbell ...	,, 13, 14.
Manning River (Taree) A. and H. Association ...	W. Plummer ...	,, 14, 15.
Lithgow A. and H. Society	M. Asher... ...	,, 15, 16.
Shoalhaven (Nowra) A. and H. Association ...	R. Leeming ...	,, 15, 16.
Marulan P. and H. Society	H. Morrice ...	,, 23.
Kangaroo Valley A. and H. Society	H. Joyce	,, 25, 26.
Candelo A. and H. Association	C. H. Brooks ...	,, 27, 28.
Tumut A. and P. Association	W. H. Bridle ...	,, 27, 28.
Tenterfield P., A., M., and H. Society	J. Harker... ...	,, 27, 28 Mar. 1.
Port Macquarie A. and H. Society	A. E. Poutney ...	,, 28 and
Lismore A. and H. Society...	C. S. Connor ...	,, 28 and 1, 2.
Berrima District (Moss Vale) A., H., and I. Society	J. Yeo	Mar. 1, 2, 3
Nepean District (Penrith) A., H., and I. Society	R. Benaud ...	,, 1, 2, 3
Robertson Agricultural Society	R. J. Ferguson ...	,, 6, 7.
Uralla P. and A. Association	J. D. Leece ...	,, 6, 7.
Bega A. and P. Association	A. J. Wilson ...	,, 7, 8.
Inverell P. and A. Association	J. M'Ilveen ...	,, 8, 9.
Picton Agricultural Society	G. Bradbury ...	,, 8, 9.
Cobargo A. and P. Society...	J. Graham ...	,, 13, 14.
Tumberumba P. and A. Society	W. Willans ...	,, 13, 14.
Glen Innes P., A., and M. Association	J. Denshire ...	,, 14, 15.
Goulburn Agricultural Society	J. J. Roberts ...	,, 15, 16.
Gulgong Agricultural Association...	C. E. Hilton ...	,, 16, 17.
Armidale (Combined Show), A. and P. Association	W. H. Allingham	,, 20, 21,
Taralga A. and P. Association	J. J. Walsh ...	,, 21, 22.
Royal Agricultural Society (Sydney)	F. Webster ...	,, 21 to 2
Braidwood P. and A. Association...	G. F. Taylor ...	,, 22, 23.
Castle Hill A. and H. Association	F. H. G. Rogers...	,, 26, 27.
Orange A. and P. Association	J. S. Thomas ...	,, 28, 29.
Walcha P. and A. Association	H. Chapman ...	April 4, 5.
Lower Clarence (Maclean) Agricultural Society...	J. S. Dunnet ...	,, 4, 5.
Camden A., H., and I. Society	W. R. Cowper ...	,, 4, 5.
Gundagai P. and A. Society	W. E. Kyle ...	,, 5, 6.
Blayney P. and A. Association	G. H. Woolly ...	,, 5, 6.
Gundaroo P., A., and H. Association	J. Affleck... ...	,, 6.
Namoi (Narrabri) P., A., and H. Association ...	J. Riddle... ...	,, 11, 12.
Bathurst A., H., and P. Association	W. G. Thompson..	,, 11, 12,
Clarence (Grafton) P. and A. Society	T. Page	,, 18, 19.

Society.	Secretary.	Date.
ton P. and A. Association	R. Porter	April 18, 19.
River (West Maitland) A. and H. ociation	W. C. Quinton ...	„ 18, 19, 20.
., A., and H. Association...	G. H. Taylor ...	„ 24, 25, 26.
a P. and A. Association	W. B. Giddes ...	„ 25, 26.
Agricultural Society	J. M. Cox ...	„ 26, 27.
(Kempsey) A. and H. Association ...	H. R. Gray ...	May 9, 10, 11.
(Moree) P. and A. Association	J. G. Cohen ...	„ 9, 10.
Hunter (Muswellbrook) A. and H. ociation	Price Healey ...	„ 16, 17.
lanning (Wingham) A. and H. Society...	J. J. Herkes ...	„ 16, 17, 18.
, Thornleigh, Pennant Hills, &c., H. ociation	H. Epthorp ...	„ 23, 24.
k P. and A. Association	W. Newmarch ...	„ 24.
P. and A. Association	E. H. Prince ...	June 20, 21.
P. Association	F. C. Thompson ...	„ 7, 8.
. and A. Association	A. Roxburgh ...	„ 13, 14.
in P. and A. Society	H. J. Wooldridge	July 19, 20.
(Jerilderie) P. and A. Society	J. Fulton	„ 24, 25.
and A. Association...	F. W. Blanche ...	„ 26, 27.
era P. and A. Association	J. F. Willans ...	Aug. 2, 3.
P., A., and H. Association...	W. G. Dowling ...	„ 9, 10.
n (Singleton) Agricultural Association ...	C. Poppenhagen ...	„ 15, 16.
P., A., and H. Association	H. S. Harwood ...	„ 15, 16.
P. and A. Association	G. Cousins ...	„ 16, 17.
A. and P. Association	C. L. Blair ...	Sept. 4, 5.
., A., and H. Association...	S. Wright... ...	„ 5, 6.
bidgee P. and A. Association (Wagga) ...	H. T. Davidson ...	„ 5, 6.
a P., A., and H. Association	J. F. Clifford ...	„ 13, 14.
P. and A. Association	G. E. Mackay ...	„ 13, 14.

ecretaries of Societies are asked to forward dates of forthcoming Shows as soon led.

[3 plates.]

THE

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3—94 (a)

CONTENTS.

Syncarpia laurifolia, Ten.

"The Turpentine."

A. Group of Saplings, showing the umbrageous character of the tree.
B. Bunch of Mature Fruits.

(11b 78-94)

Useful Australian Plants.

By J. H. MAIDEN,
Consulting Botanist.

No. 12.—The Turpentine-tree.
(*Syncarpia laurifolia*, Ten.)

original Names.—The tree was called Booreeah by the Illawarra blacks, a Murra by those of the Ulladulla district (Forester Allan), and Killa ra by the Brisbane Water blacks, according to the late Sir William rthur.

tanical Name.—*Syncarpia*, indirectly from two Greek words, *sun*, her, and *karpos*, a fruit, in allusion to the heads of fruits which have calyces joined or grown together (connate). This may be readily seen the figure.

ere are two other species of *Syncarpia*, viz.:—*S. leptopetala*, very closely l to *S. laurifolia*, which is found in Northern New South Wales and nsland, and sometimes goes under the name of "Brush Turpentine," Myrtle." The other species is *S. Hillii*, called, like the other two, rpentine," but also "Peebeen," which is the aboriginal name at Fraser's d (off the Queensland coast) where it is found.

nonym.—*Metrosideros glomulifera*, Sm. *Metrosideros*, from two Greek s, *metra*, the heart of a tree, and *sideros*, iron, in allusion to the ness of the timber. *Glomulifera*, from *glomulus* (Latin), a little round , in allusion to the flowers and fruit-heads.

e genera *Syncarpia* and *Metrosideros* are so very closely allied that some nists unite them. Baron von Mueller does. I have followed the *Flora raliensis* and *Genera Plantarum*, in both which works *Syncarpia* and *osideros* are kept as separate genera, though their affinity is noted. This ay of explanation that *Metrosideros* for our Turpentine is not wrong; se is a matter of opinion. It is also to be borne in mind that the name *arpia* for our Turpentine is so very generally used that it would seem a now to disturb the usage, especially as it is not incorrect.

e use of the genus *Metrosideros* reminds one how largely that genus is loped in New Zealand.

. robusta, the "Northern Rata," is a hard, heavy, dense timber, and, our Turpentine, destitute of figure. According to Kirk, it has been for tramway sleepers with good results, and it is the chief timber em- ed for the arms of telegraph posts. The durability of this timber is ed by old specimens which have been lying in the bush for uncounted

years, until they have been overgrown by mosses, ferns, and small sh
and even by larger trees, still remaining sound and good. Pretty muc
same can be said of our Turpentine.

M. lucida, the "Southern Rata," is a smaller tree, but still a valuabl
durable timber.

M. tomentosa is the Pohutukawa of New Zealand, and a very u
durable timber. With reference to Turpentine and the *Teredo* questi
may be interesting to note that Kirk says of the Pohutukawa, "I
never seen logs seriously injured by the perforations of this destru
mollusc." It, however, differs from Turpentine in affording excellent
wood, although difficult to split.

Flowers.—White, and in small round balls, consisting of a numb
individual flowers joined together by their calyces.

Fruit.—Hard and woody, and containing abundance of the brown,
like seed which sheds as soon as the fruits get dry. On the fruit are
seen globules of the so-called "turpentine."

Leaves.—Somewhat laurel-like, as the specific name denotes. The u
side of a dirty white, with small black patches, caused by a minute fun

Exudation.—If the tree be wounded, there exudes a brownish liquid
If it be desired to collect this substance in quantity, the best way is t
a tree and cut it into logs, which may be inclined. The resin will e
forming a ring between the wood and the bark, and may be scraped o
drained into a suitable vessel. It belongs to the class of bodies kno
"oleo-resins." It promises to be a highly interesting body, and is
chemically examined.

Bark.—The bark is of a flaky, fibrous character, and often of conside
thickness. It is of a brown colour. In large trees it has a furrowed ap
ance. The bark of our turpentine-tree does not appear to be put to
useful purpose, but the Hon. W. Pettigrew states that the bark o
Peebeen (*S. Hillii*) is used by the natives of Wide Bay (Queensland
the purpose of making canoes.

Timber.—Valuable for posts in timber fences, as it is strong and
durable underground. It is used to a limited extent in ship-building
the Jurors' Reports, London International Exhibition of 1862, it is s
to be "the best wood for railway-sleepers." At the present day, how
it is never knowingly used for such a purpose, its tendency to warp and
being against it.

Turpentine timber is not easy to burn, except with a good draught
such situations as pillars, girders, &c., in buildings, it usually only c
and is consequently easily extinguished—a very useful property in build
I was informed that, in a very large fire in Sydney, surprise was expr
that the building was not gutted, for, the wooden girders and joists
put to a very severe test. It was believed that the girders were iron
and they were so specified, but the contractor substituted turpentine wi
anyone being any the wiser. This pious fraud was, however, the mea
minimising the destructive effects of the fire.

Another instance of the substitution of turpentine for ironbark wa
so happy. In a certain suburb some carters did a roaring trade in "
bark" firewood at a rate very much below that ruling for ironbark. W
the wood began to be used complaints were very general, for it would
with difficulty. I found that the wood was turpentine, and that these c

ing carters had been clearing a turpentine paddock about 2 miles away. se incidents show that ironbark and turpentine bear some superficial mblance, but substitution of one for the other should be detected by any ful man.

is, perhaps, the best timber we have for piles, &c., for sea-water, as it resistant to the *Teredo* and other marine borers. This immunity is ved to be owing to the layer of oleo-resin between the bark and wood, h is distasteful to animal organisms, but we have no absolute experi-ts on this point. Turpentine piles are always driven with the bark on, hen stripped of their outer covering, they are by no means proof against ttacks of marine and other borers.

pile was exhibited at the Colonial and Indian Exhibition of 1886, taken a jetty at Brisbane Water, near Sydney, where it had been fully exposed e waves of the Pacific Ocean for twelve years. It had been entirely otected, yet on cutting it through it was found to be perfectly free from y, and from the attacks of the *Teredo*. I am informed that piles of this er have been known to remain sound, even for thirty years in sea-water. also very durable in fresh water.

e Hon. W. Pettigrew, a Queensland timber merchant, however, states:— is timber was said to be capable of resisting the cobra, and thereby a t value was set on it by the Government, yet when tested by the bour-master at Brisbane, it has been found that such is not the case, as imens on the table will show." I give this statement of a gentleman of reputation in colonial timbers on the principle that, advocate as I am heir use, I always draw attention to any defects I may know them to . It is, however, so opposite to my direct personal observation that I readers of the *Gazette* will come forward with their testimony in rd to the durability of the turpentine in sea-water.

is very resistant to white ant, but it must be remembered that no er is absolutely white-ant proof, as white ants, if put to it, will probably ny timber on the face of the globe.

is said to be comparatively soft and brittle, but perhaps there is some ake in this, as I have always found it to be as hard as the average aceous timbers, and it is not brittle when the sap-wood is removed. In essor Warren's work on Australian timbers there are a number of tests the strength of this timber to which I desire to refer my readers.

ke many other myrtaceous timbers, such as myrtles, turpentine is very e to rend in drying. It also warps when much exposed, unless seasoned unusual care; this is a drawback to its use for uprights in buildings.

ze.—From 120 to 180 feet is no uncommon height for this tree to n. It often measures 20 to 30 feet in circumference, with great length ole, but such magnificent specimens are, within easy range of Sydney, lly found in gullies difficult of access.

istribution.—The return herewith gives valuable information concerning entine, and is a guide to the distribution of this timber. I may mention it extends throughout the coast districts from the Tweed to the dulla district, arriving at its greatest luxuriance in deep gullies con-ng good soil, in which situations it is found a considerable distance nd into the mountains and table-lands. The southernmost tree known at ent is at the head of the Cockwhy Creek, between Ulladulla and man's Bay. It is also found in Queensland. Its occurrence is usually n of good soil.

TURPENTINE *Syncarpia laurifolia*).

No. of F.R.	County.	Area in acres.	Class.	Size of trees.	How distributed. Number of trees.	Over area.	Royalty per 100 sup. ft.	Quality.
				ft. girth		acres.	pence.	
43a	Camden	59	C	9	12 over	59	3	Good
78	,, ...	202	C	8	4 ,,	202	3	,,
172	,, ...	170	A	6	4 ,,	100	...	Fair
173	,, ...	100	C	7	2 ,,	50	3	,,
201	,, ...	100	A	8	4 ,,	100	...	Good
203	,, ...	250	A	6	2 ,,	100	...	Fair
207	,, ...	650	A	6	2 ,,	200	...	,,
209	,, ...	1,000	C	6	2 ,,	100	3	,,
211	,, ...	34	A	6	2 ,,	20	...	,,
219	,, ...	50	A	6	3 ,,	50	...	,,
1,966	Cook	4,600	A	6	4 ,,	1,000	...	,,
110	Cumberland ...	5,408	C	5	4 ,,	5,408	3	,,
112	Dudley	2,453	A	6	6 ,,	500	...	,,
158	,, ...	79,680	C	8	3 ,,	20,000	6	Good
3,753	,, ...	16,000	C	7	2 ,,	2,500	6	,,
14,537	Dudley and Raleigh.	47,205	C	8	1 ,,	3,000	6	,,
196	Durham	10,000	C	...	......	......	6	Fair
201	,, ...	22,442	C	...	......	......	6	,,
202	,, ...	48,000	C	...	......	......	6	,,
642	Fitzroy	30,043	C	6	1 over	10,000	6	,,
13,362	Gloucester ..	3,730	A	6	......	......	...	,,
58	Hunter	6,120	A	6	......	......	...	,,
5,612	,, ...	22,000	A	6	......	......	...	,,
33	Macquarie ...	21,000	C	6	......	.. ...	6	,,
34	,, ...	10,000	A	6	......	......	...	,,
144	,, ..	12,262	A	6	2 over	12,262	...	Good
233	,, ..	280	C	6	1 ,,	280	6	Fair
234	,, ...	610	A	6	1 ,,	610	...	,,
235	,, ...	3,840	C	6	4 ,,	600	6	Good
46	Northumberland	15,954	C	12	5 ,,	2,000	6	,,
63	,, ...	990	C	7	2 ,,	100	6	Fair
69a	,, ...	6,393	C	6	2 ,,	1,000	...	,,
70	,, ...	33,186	C	6	1 ,,	16,000	6	Good
124	,, ...	4,160	A	6	4 ,,	250	...	Fair
128	,, ...	1,280	C	6	5 ,,	400	6	Good
136	,, ...	440	A	6	2 ,,	200	...	Fair
207a	,, ...	66	A	6	5 ,,	20	...	,,
216	,, ...	9,700	C	6	2 ,,	4,000	6	Good
217	,, ...	3,000	A	6	2 ,,	300	...	,,
5,310	,, ...	970	A	6	1 ,,	300	...	Fair
14,972	,, ...	6,150	C	6	2 ,,	3,000	6	Good
249	Rous	16,661½	C	7	1 ,,	6,000	6	,,
258	,, ...	1,280	C	9	2 ,,	800	6	,,
129	St. Vincent .	500	A	6	2 ,,	400	...	,,
10,616	,, ..	49,250	C	6	5 ,,	5,000	6	,,
101	Westmoreland ...	62,000	A	7	6 ,,	1,000	...	Fair

Propagation.—From seed, which is very freely produced. This tree is c
of the best indigenous shade-trees in the Colony. It is gregarious, and
noble, leafy head makes it an ideal tree under which to put garden seats,
to serve as shelter-trees for men or animals in a paddock, or as specim
trees, to give a park-like appearance to land. It is one of those trees t
should always be spared, in clearing operations, unless its room is actua

ted. It is so different in appearance to the ordinary run of gum-trees the occurrence of turpentines is often a relief to the eye. My experi- tends to show that turpentines have a large number of roots near the ace, which, if disturbed, readily kill the tree. I would not, however, like eneralise on this point. I have seen some experiments on pollarding the entine. The trees were cut in the month of May, and have freely sent leaf-buds a considerable distance down the trunk, giving the tree quite rnamental appearance. Where a tree is growing too large, and it is necessary to absolutely remove it, the experiment I have indicated might nade.

ference to plate.—1, group of saplings, showing the umbrageous character of the tree; nch of mature fruits.

The True Star Thistle.

(*Centaurea calcitrapa*, Linn.)

One of the Worst Weeds in the Colony.

By J. H. MAIDEN.

Vernacular names.—This is the Star Thistle, or the true Star This called in England. It has been sent to the Department from Grenfe Gunnedah as the "Pink Chinese Thistle" (to distinguish it from the one, *Kentrophyllum*), but the Chinese would be justified in repud the association as an insult.

Botanical name.—*Centaurea*—With an allied plant, the Centaur Chi said to have cured the wound in his foot, caused by the arrow of He *Calcitrapa.*—The name is in allusion to the resemblance of the calyx *Calthrops*, or iron-ball, covered with spikes, formerly used for thr under the horses' feet to lame them on a field of battle.

This thistle seems to be execrated by everybody. In regard to most which are reputed to be a nuisance, apologists find at least one rede feature in them, but I have never heard a good word put in for th Thistle. It is a vegetable outlaw, and every man's hand is against would be, if it were not so prickly.

The indictment against the Star Thistle is that it is a terrible pest. not edible (fresh or as ensilage), it covers the ground with a prickly g which impedes the locomotion of sheep, cattle, and man; it smoth other herbage and grass.

I have already spoken of the Thistle Acts of Victoria and South Au in my account of the "Saffron or False Star Thistle" (*Kentrophy May Gazette*, page 298. Apropos to the South Australian Act of 188 "Star Thistle" aimed at was *Kentrophyllum*, as this was supposed to genuine article, but, curiously enough, the *real* Star Thistle (*Cen calcitrapa*), made its presence felt about the time of the passing of the and so, as it was not specifically stated which Star Thistle was alluded may be taken to refer to both. Whenever I get the opportunity, I inc the use of botanical names with the view of precision, but here is actu case in which the suppression of a botanical name was a real adva However, I hope it will not be an encouragement to looseness of nomenclature.

Popular description.—A weak-stemmed, scrawling, scrambling plant small pink or purple thistle-like flowers. It forms masses 2 or 3 feet hig more than that in diameter. It is not so rigid as the *Kentrophyllum* des in the May *Gazette*, but still the prickly leaves and flowers are suffic

(11b 78-94.)

Centaurea calcitrapa, Linn.

"The True Star Thistle."

nidable to cause it to be handled very carefully. Its spreading habit tects the main stem, so that it is not easy to get at the root for the pose of destroying the plant.

low to get rid of it.—Being an annual, the Star Thistle should be destroyed n just coming into flower. It can be ploughed in if the pest is abundant. ears an enormous quantity of seeds, which are wafted about by the wind, hat it is of little use to clear a paddock of the weed if there is plenty of on your neighbour's land. Road maintenance men, whether in the loyment of the Government or municipalities, should be instructed to fully destroy this and other weed pests found growing by the road-sides. d-sides are notoriously such propagating places for noxious weeds (which brought along by travelling animals, in the first place) that it is to be ed that officers in charge of roads will, as a national duty, see to the rmination of the most injurious weeds. I know that some roads officers very strict in regard to this matter, but others have perhaps hardly given erious thought. The eradication of the worst weeds would, in most ances, hardly increase the work of a man to a perceptible degree, and, i vigilance, the work to be done would rapidly diminish.

Vhere found.—The Star Thistle is a native of the countries in Europe, i and Africa surrounding the Mediterranean, and also Great Britain and er countries of middle and northern Europe. Its range is pretty well of *Kentrophyllum*. Now, however, it is to be found in probably every ntry in the world except the coldest.

here are a number of plants in the vicinity of the cattle and sheep sale-ls at Homebush. At first I knew of only one, which I used to regularly for specimens, but since then I have found several in Homebush and nington. It was probably brought to these localities by sheep, the seeds g stuck in their wool. Only a month ago Mr. Ross of Bathurst, writes he has noticed it there for the first time. It has been sent recently to Department from Wagga Wagga, Grenfell, and Gunnedah. I have seen i other parts of the Colony, and have received it from additional localities. ierally, I have noticed it in small patches at very wide intervals. It is a t insidious foe, and land owners are recommended to make themselves iainted with it, and to keep their land clear of it.

ference to plate.—A, one of the individual flowers of which the "head" is composed; "head" or thistle, in fruit, showing the formidable involucral bracts—hence the parison to calthrops; C, D, two extreme forms of involucral bracts; E, seeds.

Fish-poisons of the Australian Aborigines.

By J. H. Maiden.

The practice of throwing leaves, bark, &c., into streams and pools for t
purpose of killing fish or stupefying them sufficiently to enable them to
caught is by no means confined to the aborigines of this continent, b
appears to be practised by the natives of many tropical and sub-tropi
countries. Attention has recently been drawn to the subject through t
researches of Dr. Greshoff, attached to the famous botanic garden at B
tenzorg, Java, who has been subjecting to chemical analysis the plants us
for fish capture by the natives of that country. So far as I know,
systematic attempt has yet been made to investigate the properties of t
fish poisons employed by our aborigines. As a very general rule, the plan
employed by them are astringents or tanning agents, the tannin contain
in which may be the cause of the temporary helplessness of the fish, whi
renders them an easy prey. I do not speak positively in regard to this, f
I am inclined to think that the real active agent is a saponin, to which so
of our Acacia and other barks owe the persistent bitter taste they posse
and which is, of course, very different to astringency. The subject is o
which might well be worked up by one who desires to do original work
connection with the properties of our indigenous plants. I should be g
to receive additions to the list of plants I submit as having been used by t
blacks for catching fish.

Following is (or used to be) the method employed by New South Wa
blacks for catching fish by throwing wattle bark into streams or water-hol
In the case of streams, stakes were placed across, and a few wisps of wat
bark thrown into the water. In a little while the fish seemed to be into
cated, knocked against the stakes, appeared bewildered, and the blac
posting themselves near the stakes, took them out of the water. T
stupidity or intoxication only lasted for about an hour. The fish caught
this method are in no way impaired as an article of food.

The late Sir William Macarthur stated that the bark of *Acacia falca*
Willd., a small tree found in the coast districts, and sometimes known
"Sally" or "Hickory," used to be used by the aborigines of the counties
Cumberland and Camden in this Colony for poisoning fish. The native na
for it was "Wee-tjellan." They also employed the bark to make embro
tions for the cure of cutaneous diseases.

Another "Hickory" or "Blackwood" (*Acacia penninervis*, Sieb.), v
used by the natives of southern New South Wales for catching fish. I ha
heard that both the bark and the leaves were employed.

It is mentioned by Sir Thomas Mitchell that the blacks of the inter
made use of the bark of the "Goobang" (*Acacia salicina*, Lindl., v

ns), usually known as "Cooba," or "Native Willow," for poisoning the in small lagoons, and Mr. Hill says that the natives of the Fitzroy r (Queensland) put it to a like purpose.

he bark of the Fresh Water Mangrove (*Barringtonia racemosa*, Gaud.) fish poison of the natives of the Mitchell River, Northern Queensland. E. Palmer says the native name for the tree is "Yakooro," and that the ks cut up the bark into small pieces, hammer it fine on a stone, and then e it in water. *Barringtonia speciosa*, Linn. f., which is also a native of ensland, does not appear to be used by Australian aborigines as a fish-on, but the Fijians so employ it, according to Seemann, and they use the r portion of the fruit, and not the bark.

treya australis, F.v.M., is a myrtaceous tree, and is closely allied to the preceding plants. The bark was used by the aborigines of Cleveland Queensland, for stupefying fish, in fresh or salt water. I believe rell, a shipwrecked sailor, is the authority for this statement. Mr. E. ner, however, gives a little additional information when he states that blacks on the Burdekin use the bark of the stem to poison fish in fresh r, and the bark of the root for salt water. There is probably a sufficient on for this discrimination, and it would be well if some local resident d explain the matter.

the General Report of the Sydney International Exhibition of 1879 it ated that the aborigines used the pounded bark of *Cupania pseudorhus*, Rich., to stupefy fish in waterholes. It is a native of the north coast ict of our Colony, and is also found in Queensland.

leguminous shrub known to botanists as *Derris uliginosa*, Benth., is d in Queensland and Northern Australia, and the pounded leaves are wn into water, for the purpose of stupefying fish, by the natives of y tropical countries. No doubt this property was found out accidentally e first place;—a broken bough fell into the water and it was noticed the fish came to the surface. *Derris elliptica*, Benth., is largely used in in fishing, and appears to be also a constituent of the Borneo arrow-on. Dr. Greshoff, of the Buitenzorg Botanic Garden, has examined plant. He finds that it has an exceedingly poisonous action on —a decoction of the roots being fatal, even when diluted with 300,000 s of water. The only active constituent isolated is a resinous substance ed *derrid*, which does not contain nitrogen, and is not a glucoside; it ily dissolves in alcohol, ether, chloroform, and amyl alcohol, but is very ingly soluble in water and potash solution. On fusion with potash it s salicylic and protcatechnic acids. It occurs almost entirely in the ex of the root, but has not yet been obtained pure. Its alcoholic ion has a slightly acid reaction and a sharp aromatic taste, causing a ial insensibility of the tongue, which remains for hours. A solution of rt in 5,000,000 is almost instantly fatal to fish. (Ber. xxiii, 3,537; n. Chem. Soc. lx, 335.)

here are but very few allusions to the use by the blacks of the all-per-ng eucalyptus vegetation for fish-catching. The earliest I can find is by Thomas Mitchell (*Three Expeditions*, ii., 24), who says, in speaking of Lachlan: "There the river contained some deep pools, and we expected atch fish, but Piper (Sir Thomas' black interpreter) told us that the s had been recently poisoned, a process adopted by the natives in dry ons . . . All these holes were full of recently-cut boughs of the lyptus, so that the water was tinged black."

Speaking of the blacks of the interior of Queensland, Mr. E. Palmer the small branches of ***Eucalyptus microtheca***, F.v.M. (the "Cooliba "Flooded Box"), are cut up, and, with the leaves, are laid in wat several days to sicken the fish; it is universally used for the purpose. very likely that this is the tree referred to by Sir Thomas Mitchell.

A kind of towel-gourd (***Luffa ægyptiaca***, Miller), whose native name Mitchell is "Bun-bun," is used to poison fish when green, according E. Palmer.

Mr. C. Hedley has a note in the ***Proc. Royal Soc.*** *of Queensland*, in which he states that a species of ***Polygonum***, probably *P. ori* Linn., was pointed out to him as being one of the plants which th Curtis (Queensland) blacks use in obtaining fish, and that when a qu of it is pounded up and thrown into a waterhole, it rapidly brings fish to the surface in a dying condition, without impairing their whole ness as food.

Tephrosia purpurea, *Pers.*, is used in many tropical countries fo purpose of stupefying fish for the sake of capturing them. Speakin *Tephrosia*, whose native name on the Cloncurry is "Jerril-jerry," Palmer says the aborigines use it to poison fish or stupefy them; the plant is broken up and placed in small lagoons.

Such is a brief list of the principal plants used by the aborigines of South Wales and Queensland for the purpose of poisoning fish. It not for a moment be supposed that it includes even a small percenta our indigenous poisonous plants, scores of which could be at once quot being undoubtedly deleterious to fish. Nevertheless it would be interest take even the few I have quoted, subject them to chemical analysi thus decide to what substance the effect first noticed by the aborigin fish is due.

Botanical Notes.

BY J. H. MAIDEN.

A REPUTED ANTIDOTE TO SNAKE-BITE.

H. J. LANE, of Macksville, has recently sent to the Department some imens of a small native plant (*Lobelia purpurascens*), which is usually d in damp situations, and announces that the blacks of the Macleay er District use it as a remedy in snake-bite. He states that the blacks ke a decoction of the herb, and give the animal bitten by the snake t 3 or 4 fluid oz. From all I can learn it is only given once. The ntity of herb is about a handful gathered green."

will quote from a paper read by me in May, 1890, before the Linnean ety of New South. "This plant was sent to me in July, 1889, from Macquarie, as a newly discovered antidote to snake-bite. Mr. Hamlet vernment Analyst, Sydney) and I have both found the oily alkaloid eline in it. Dr. T. L. Bancroft kindly informs me that this species ains the some active properties as *L. inflata*, and might be used as a titute for it. The chemical experiments are thus confirmed by the siological ones. The North American *L. inflata* is collected after the -capsules have become inflated. It is emetic and expectorant, and its f use is in asthma."

correspondent from the Bellinger writes a blood-curdling yarn about a k snake and an iguana having a fight. Black snake bites iguana—iguana ing unwell scampers off for a mouthful of *Lobelia purpurascens*, and es back to continue his encounter with the snake. Another informant me that the effect of the *Lobelia* on the iguana is to make him vomit he snake-poison.

have had a number of letters and conversations, from which I underd that this belief in *L. inflata* as an antidote to snake-poison is very erally held on the northern rivers. Now I want to know what is the s for this opinion. Can anybody give me specific instances of men or nals who have recovered from the bite of a poisonous snake after treatt with *Lobelia purpurascens ?*

he plant undoubtedly contains an active principle, but will it act in the ction suggested? Of course we have to be nearly as cautious in dealing snake-stories as in dealing with snakes themselves. I hope, therefore, readers will thoroughly satisfy themselves as to the genuineness of any res" they may refer to.

SYDNEY-GROWN ACACIA PYCNANTHA BARK.

s is the Broad leaf or Golden Wattle of South Australia, which is now roughly acclimatised in New South Wales, and in years to come, I see no son why the finest wattle-bark in the southern hemisphere should all be

grown in the sister Colony. The plant has attracted some attention ornamental plant, and flowering sprays of it have been sent in for nam Sydney nurserymen, and by people in various parts of the Colony. although it is settled beyond dispute that this species will flourish he knew nothing of the quality of the Sydney-grown bark. I have been e menting with the species in a western suburb, 8 miles from Sydney, an a number of barks from young trees, concerning which I have data time of planting, stripping, &c. Following is an average instance:- planted in bamboos, July, 1891; bamboos planted out in trenched g 15th September, 1891; soil, stiffish clay, never manured, or artificially wa stripped on 20th January, 1894, the tree having then attained a hei 16 feet, a diameter of trunk of 4 inches, and in full growth. Bark an May, 1894, with the result of 38·25 per cent. of tannin (Löwenthall' cess used). The liquor is of excellent quality. This from a mere sapl only 2½ years age from time of sowing the seed. In practice no one ever dream of stripping his wattles at this early age, for, as is well k such young plants are too small, and the bark has not attained its max percentage of tannin. My experiments show that the tree loses none economic value in its new home, and it is undoubtedly one of th valuable introductions to those parts of New South Wales in which it indigenous, which have been received in recent years.

FALSE TONQUIN BEANS.

A CORRESPONDENT in a northern mining town sends to the Departm nut, with a request for the name, and the statement, "It has been sol as a Tonquin nut, and represented by the seller to destroy moths, &c."

This so-called Tonquin nut is a seed of the maiden-hair tree of Chi Japan, known to botanists as *Ginkgo biloba*, Linn., of which *Sali adiantifolia*, Smith, is a synonym. These nuts are roasted for food natives of the countries named. They are without odour, but the part nut sent by our correspondent was rubbed with some bad scent or (presumably to imitate a Tonquin bean). The maiden-hair tree see utterly worthless for the purpose of destroying moths (so are Tonquin for that matter). Tonquin nuts or beans are very different in appear

I hope that not many people have been "let in" by this enterp trader, but they will have the consolation of knowing that in future have the Department to apply to for advice of this nature.

Extracting Perfume from Flowers by the Enfleurage and Maceration Methods.

HE following report has been submitted by Mr. B. G. Hardy:—

I have the honor to forward to you my report on the above subject.

I proceeded to Gosford on the 19th of February last for the purpose of aking a series of experiments in the nursery of Messrs. Pearce Brothers, ll details of which are hereafter given.

First I must state a matter for considerable regret, inasmuch as on my rival there the weather had a promising appearance for a continuance of e weather, but immediately after I had commenced work an unfavourable ange took place, and heavy rains set in. This, unfortunately, continued ore or less for thirty-five days, with only two exceptions, and during that riod over 14 inches of rain fell.

It is hardly necessary for me to point out how detrimental this would be the retention of the perfume by the flowers until I could work them, and almost every case, all through the work, I had to express the water from e blooms before I could lay them down, thereby losing a very valuable rtion of their odour.

Beyond this, I was, throughout the work, at very considerable disadvantage om insufficient space and the primitive nature of the building placed at my sposal for operating in, and the irregular and curtailed supply of flowers. n the latter point, I may explain that I never commenced work on a flower ithout first inquiring if there would be a sufficient supply of bloom available regular intervals to carry the experiment to completion, but I frequently und, when at actual work, that from some cause or other I could not tain a recharge for sometimes nearly a week instead of daily, and at other nes the bloom allowed to me totally ceased after, perhaps, one, two, or ree changes, in place of at least a dozen required.

It will thus be seen that the whole of this work has been carried out der most discouraging circumstances.

I feel called upon to make these explanations, because much more time s been occupied than was anticipated when I undertook the work, and also account of some of the samples not being as complete as I would wish. evertheless, in every case they are satisfactory in quality and strength, as r as the opportunity would allow, and demonstrate the facts that, under ore favourable circumstances, articles of high quality may be produced and rried forward to commercial success.

Bouvardia (Humboldtii).

This sample was prepared from 3 lb. 6 oz. bloom, 4 lb. prepared fat, four anges.

Up to the present this plant has not been used by manufacturing permers, but our experiment proves that in this climate it develops into a

most useful source of perfume, which would be quickly taken up by trade as a new article. It is very powerful, yet delicate in odour, possesses all the qualities requisite as a "body" for first-class bouquet.

Tuberose (Double).

Prepared from 5 lb. 13 oz. bloom, 4 lb. prepared fat, with six change

Being supplied with larger quantities of this flower, a very grati result has been obtained, and I consider this the finest sample procur this series of experiments, not on account of the article being of more than the others, but simply because I had a more ample supply of blo work upon.

The perfume from this is very pronounced and sound; in fact, i weather had been favourable, instead of such heavy and continuous rai sample I feel confident would have been perfect.

From personal experience with the tuberose, I do not hesitate to that our extracts from this plant could be placed on the market and re sold at such prices as would prove very remunerative to those interest its cultivation and manufacture.

Rose, White Assorted.

Sample made from 7 lb. 11 oz. flowers, 10 lb. prepared fat, with changes.

In this sample the odour is strong and very distinct, and, considering difficulties attendant upon the excessive rain alluded to, have deve beyond my expectations.

One gratifying fact has been demonstrated, that by this process ma used, with more or less success, the majority of the roses now cultivat this sample is secured from the blooms of a collection of varieties, white and yellow.

Rose, Assorted Reds.

Sample made from 8 lb. 1 oz. flowers, 10 lb. prepared fat, with changes.

The foregoing remarks on the combinations of varieties are also appli to the coloured roses, the majority of which can also be success combined.

Considering the quality of the bloom available, so much deteriorate the rains, this sample is very fair, and compares favourably with that o white class.

The manufacturers could use both these samples to advantage; th the samples are very good.

Carnations, Assorted.

Prepared from 2 lb. 12 oz. bloom, 4 lb. prepared fat, with two change

This will be another new line of goods, and if brought forward wou believe, prove acceptable to the trade, and show a fair margin of prof the producers.

The perfume from this is fragrant, powerful, and lasting, and would general service as a "fixing" ingredient for making articles of average qu

Phlox, Perennial, Assorted.

Prepared from 1 lb. 3 oz. flowers, 4 lb. fat, with two changes.

In this sample of perennial phlox we have a very peculiar, distinct, and luable odour, hitherto unknown to the perfumers.

The experiment has been very encouraging as far as I have been able to oceed, but owing to the unexpected cessation of my supply of bloom I re not been able to develop this in its perfection. I am, however, satisfied at we have obtained here, as stated, a new fragrance of great service to trade. I believe that high-class results will be obtainable in this climate m this plant.

Spikehead.

Prepared from 8 oz. flowers, 3 lb. fat, and just enough bloom for one er.

Here we find another line previously unknown, the odour of which is y delicate, and the utmost care and attention is required in handling bloom, otherwise the otto, which is exceedingly volatile, escapes. The nple, although such a small quantity of flowers was used, proves that a y fine perfume may be secured that would be valuable for high-class ds.

Assorted Flowers.

No. 1, prepared from 2 lb. 6 oz. coloured flowers, 4 lb. fat, with five nges. No. 2, prepared from 2 lb. 12 oz. white flowers, 4 lb. fat, with six nges.

Seeing the multitude of varieties of flowers then present in the nursery, it ick me it would be a good opportunity to investigate, for the benefit of small wers and those who would prefer to grow flowers in collections, to what ent assortments of various blooms might be combined and the value of ir products ascertained. For this purpose I selected flowers in such nbination as would by their blended odours be acceptable in a lady's iquet. The results have proved very gratifying, giving excellent samples t would pass current in the trade as "Ess. Bouquet," thus showing that h judgment this very popular perfume may be produced in its purity ect from the combined flowers, instead of the usual intricate method of nding at present in vogue.

There were several other experiments tried on florists' flowers, but the ults were not sufficiently satisfactory from a commercial point to be rthy of further prosecution or record.

To sum up the value of these experiments as an industry and source of ome, I feel confident it could be made the means of hundreds of small d-owners, families of limited means, and even semi-invalids increasing ir incomes very considerably.

The practical work of extracting is not difficult to learn, and may be ccessfully carried out by any intelligent person.

The cultivation necessary in flower-farming is very simple, and after the d has once been prepared there is no heavy labour, thus bringing it within class of light industries very suitable for a section of our population it would be thankful for such means to earn a livelihood.

The growers of these flowers would have no difficulty in selling their ops of bloom as they came forward should they be produced in fair quanies, and a company be formed to carry on this industry.

On the other hand, if the growers prefer to work up the blooms th selves, the only point for consideration is that the article must be first-class quality, as only good productions would have a chance of secu a payable market. For such there is practically an unlimited deman the supply of a pure article has never been equal to the requiremen Europe or America, and this will account for the large quantities of chem perfumes, which are of an injurious tendency, being thrust on the pu

Beyond the ease with which the usual perfume plants may be cultiv and developed here, I would point out that we have a large number of ot which in this favoured climate would come well within range of flo farming, and that are at present quite outside the limited circle of pl utilised for these purposes.

For instance, we have certain of the florists', or cultivated, flowers w are not, to our knowledge, worked elsewhere for perfumes, but which, us, develop new and unique odours, that would be eagerly availed o the leading manufacturers of the world. Again, we have the almost i haustible supplies of our native flora, about which we have only fluttere the borders, as it were, leaving the inner depths comparatively unkno but what little we do know only excites our desire for a closer acquaint with her odoriferous wealth.

As a practical perfumer, having had many years' experience both Europe and Australia, I would express my opinion that, should the Honor the Minister see fit to continue this line of experiments, it would be fo that many of our native plants might profitably be brought into cultiva for perfumery purposes, and give odours of a special value to the trad manufacturing new preparations, and without doubt the very fact of offe new specialities in Australian perfumes would operate beneficially in sale of all our other perfume products.

Budding.*

By B. M. LELONG.

HE process of budding is performed during the growing periods of the
rious kinds of trees. The peach, cherry, almond, apricot, plum, &c., are
ıdded as soon as the scions, or buds, have developed or matured in the

Fig. 1.—A The point which should not be used, as the buds are generally blind. B Point from where the buds are developed. C Beyond this point the buds are too tender, and should not be used. D Indicates the scion, or budding stick, to be used, being between points B and C. E The scion, or budding stick, trimmed ready for budding.

ring or midsummer, and if budded early they can be started the same
ason, but if budded late they have to be left dormant through the winter.

* This article is reproduced from the Annual Report for 1891 of the Board of Horticulture of the State of California.

The apple, pear, quince, &c., are budded in the summer, and as they do n grow as rapidly as the peach, almond, &c., they are left to lie dormant the following spring, when they are started. The orange, lemon, lin citron, &c., are budded all through the summer, from early spring. T best time, however, is just as the sap begins to rise. The buds at that ti "take" more readily, and the growth is undisturbed through the grow period of the tree. The fig, walnut, chessnut, &c., are budded during summer, and the buds left to lie dormant, to be started in the spring. T olive and other evergreen trees of this kind are budded from the time sap begins to rise in the spring until late in the fall. If budded early, th are started and make good growth the same season. If budded late, th must be left to lie dormant till the spring following, when they are start

Budding the Peach.

The budding of the peach is, perhaps, the most simple. The buds t more readily, and less care and practice are required than in budding ot

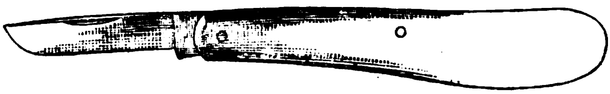


Fig. 2.

trees. The first important factor is the selection of scions, or buds. illustrations (Fig. 1) furnish a good example of the budding sticks and method of preparing them for budding. The budding sticks or buds hav been prepared, they are placed in a box, and cove either with wet sacks or moss. In taking them the field, it is advisable to never allow the sun strike them. A small, shallow box, with a layer wet moss at the bottom, on top of which the b are placed and covered with a wet burlap sack much preferred. As the operator proceeds, only stick is taken out and used at a time.

Fig. 3.—A The stock. B The transverse cut. C The vertical incision.

The operation is performed with a sharp kn called "budding-knife." Fig. 2 represents a favou style. There are others that are also very good, s as the IXL, or Wostenholm.

A vertical incision is made in the bark of young tree by simply pressing the point of the k against the bark and drawing it up, making a from about one-quarter to one-half of an inch l Then by placing the knife transversely, and wit slight twist of the hand from left to right, the tr verse cut is made (Fig. 3). At the same time edges of the bark become loosened, so as to e admit the bud; then by pressing the bud it will w its way downwards in the slit until it reaches a position, and the bark covers it tightly. The b are then tied firmly with good, soft cotton twine, left in that position until the time comes for the strings to be cut, or buds started or left to lie dormant, as will be explained later on.

The cutting of the bud from the stick becomes an important factor. The ud should not contain too much wood, and should not be cut so thin that

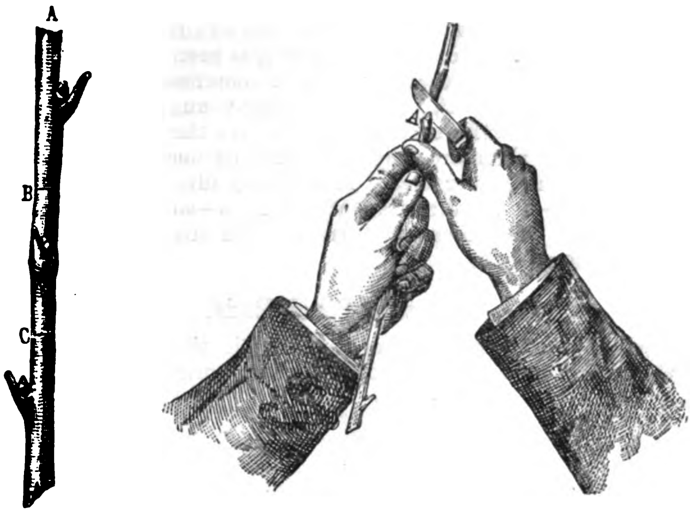


Fig. 4.—A The scion, or budding stick, showing how the buds are cut, and the position in which the knife is held. B C Points indicating the length to cut the buds.

NOTE.—These illustrations show how the buds are cut with the point of the bud upwards, but they may be reversed if the operator so chooses.

en tied it is squeezed into nothing. For this reason it is always advisable use large and plump buds. The stick is held firmly with the left hand and the bud cut with the right, as shown in Fig 4.

. 5.—A The stock. B The bud inserted.

The bud is then inserted in the slit or incision, as shown in Fig. 5. The bud is then tied; for this purpose good, soft cotton twine is the best. The work can be done more expeditiously, and the results will always be more satisfactory than when other materials, such as cloth strips, &c., are used. Many tie differently from others. Some prefer to commence the operation by wrapping the twine below the bud first, and wrap until the top is reached. I much prefer to begin the wrapping above the bud and finish at the bottom. It is of great advantage, because the bud will not slip while being tied, and it is kept in position, and instead

Fig. 6.—A The stock after budded. B The twine as tied. C The tie at the finish. D The tie at the beginning.

allowing it to slip or relax, drives it down further into the slit, and in is way a most perfect fit is obtained. The principal and most important

part of the operation lies in tying the buds well, for if they should be tie loosely the air gets between the bud and the inner bark of the stock, causin the sap between them to dry and prevent adhesion.

If the weather is favourable, the strings can be cut in fourteen days. I case there should be a continuance of heat it is better to leave them undis turbed for another week, because the heat sometimes causes the bark t open and the buds to dry out. In the summer young peach-trees grow ver rapidly, and sometimes the strings will cut into the bark, and in this wa many buds are lost; therefore they should not be neglected, and the string should be cut at the proper time. It is always advisable to insert the bud pointing one way—in the direction of the rows—so that in searching fo those that miss, in rebudding, or in cutting the strings, a person need no spend time in searching to find them.

Starting Peach Buds.

The most important point after budding is the starting of the bud When the plants have been budded in early spring (June) they can b

Fig. 7.—A The brush left on the stock to induce the bud to start, by acting as suctions—drawing up the sap. B The stock. C Point where the bud may be tied to protect it from breaking. D. Point where the old stock is to be cut away, the dotted line below it indicating how much the bud is endangered by cutting lower than this line.

started, and the buds, if properly attended to, will become saleable tre by winter, known and designated as June buds. The starting of a Ju

ud requires care, as the trees are young and full of vigour, and brittle to a
ertain extent. If the tops of the stocks are cut entirely off, as in starting
uds in the spring, the shock to the stock is too great, and will stop the
nmediate flow of sap, and the tree will die. The best way is to bend the
ee over, and by giving it a twist the stock will crack about the centre (say)
bout 10 or 12 inches above the bud. This will give the stock a slight
ock, although so slight as not to disturb the flow of sap, and at the same

Fig. 8.—A The stock trimmed of all growth. B The point where the bud was inserted. C The point where the top was cut off to start the bud. D The bud started.

me induce the bud to start. When the buds start and have made a growth
 3 to 4 inches, the main stock is cut away about 8 inches above the bud,
ut should not be cleared of all the brush, as the stock may die back and
ndanger the buds. It is always better to allow a little of the brush to
emain, as shown in Fig. 7, at A.

After the bud has made a growth of a foot or more the stocks are cleared
f all brush, and the stump may then be cut back, but it is better to leave it
ntil fall.

With buds that are let go and lie dormant, the operation is somewhat
ifferent, and does not require the attention given to starting June buds.
n February the stocks are cut back about from 4 to 6 inches above the bud;
hen all the brush is cleared away and the nursery cultivated. Nothing then
emains to be done but to wait for the buds to start, and with them there will
e numerous suckers, or shoots, that have to be removed from time to time.

These are removed by hand-pruning, they being very tender break touch. When the buds have made a growth of about a foot or over take the entire flow of sap from the stock, and therefore suckering be less necessary. The buds may be tied to the stock, so that they may a straight tree; but this is seldom practiced, and is only done where are not grown extensively, as the buds grow remarkably straight i nursery.

Spring Budding.

In this method the tops of the stocks are not removed, but are left turbed, so that when they leaf out the bark may slip easily, otherwise become tightened, so as to prevent budding at this time. Peach see generally leaf out early, and buds inserted at this time grow and make trees by fall. As soon as the bark separates from the stock the bu inserted in the ordinary way. Three weeks after the strings are ren and the tops cut back to force the buds to start, the same as in June bu The scions or buds are from wood of the previous season's growth, an gathered early, and kept with the larger ends in moderately moist sa a cool place. This prevents them from starting, and they can be kept late in the spring.

Budding the Orange.

The best time to bud the orange is in March and April, just as soon trees begin to show signs of growth. The sap is then rising, and if bu at that time, almost every bud will take, and in less than a month will It is best not to cut the entire foliage of the stock when starting the a little should be left to keep the sap in the stock flowing, and induc buds to start. Summer budding is performed in July and August, bu buds do not then start even, and as many start so late the growth by w is quite tender, and the trees are liable to be nipped by frosts.

The selection of the buds is very important, and only the best shou chosen. When weak and immature buds are inserted they often re dormant in the stock a year before starting. Buds to be left to lie dor are put in as late as possible, but before the stocks begin to relax in gr to prevent them from starting at that season and the bark growing over

Stages of Budding Citrus Trees.

The different stages of budding the orange, lemon, lime, citron, &c as follows:—

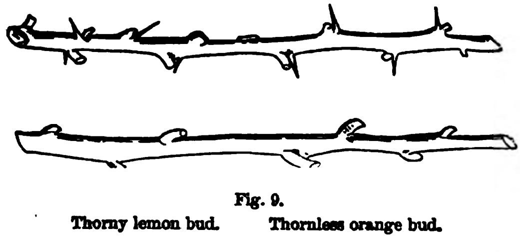


Fig. 9.

Thorny lemon bud. Thornless orange bud.

The selection of proper buds is a very important factor, Fig. 9 illustra the kinds of scions or buds to select.

First—The vertical incision in the bark, and the position in which the
ife is held. (Fig. 10.)

Fig. 10.

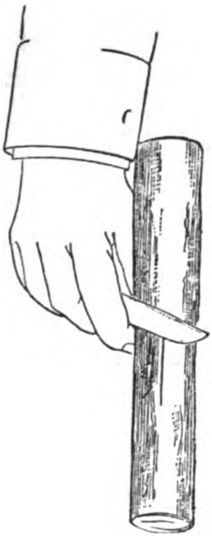


Fig. 11.

Fig. 12.

econd—The transverse incision. (Fig. 11.)
hird—The opening of the bark by a slight twist of the hand from left to
it. (Fig. 12.)

Fig. 13.

ourth—Cutting the bud. Fig. 13 shows position of the hands and knife,
the point of the buds downward. In this way the buds are cut cleaner
much sharper, and do not crack in cutting.

Fifth—Bud inserted. (Fig. 14.)
Sixth—Bud tied; operation complete. (Fig. 15.)

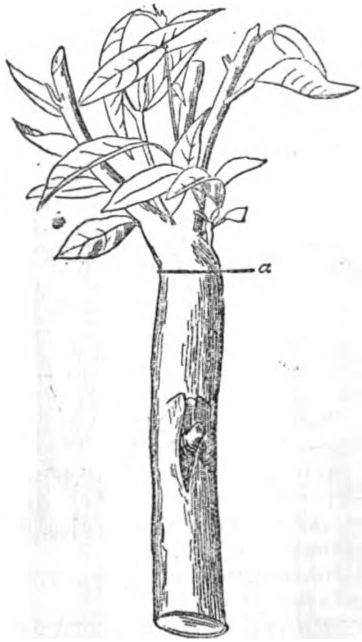


Fig. 14.

Fig. 15.

In these latter figures (Figs. 14 and 15) the method of cutting bac stock to start the bud is shown, and the portion of brush and leave remaining, to prevent a check in the flow of sap, which are removed when the buds have made a start of 2 or 3 inches, at the point shown a

Apples.

Budding apple seedlings is not a difficult operation; that is, it do require so much skill as do other trees. The operation is performed d the growing season, generally in August and Se ber. The incision in the stock is made in the manner as described for the peach. The bud cut from a shoot of the current season's gr about an inch and a quarter long—a $\frac{1}{2}$ above $\frac{3}{4}$ below—as shown in Fig. 16, and inserted und bark of the stock in an incision previously ma is shown in Fig. 17, and is then tied with c twine; for this purpose sixteen-ply is most p able. In three weeks the twine is removed, the bud has "taken," it is left to lie dormant the spring following, when the stocks are cut (in March) to force the buds to start. It is necessary that the stocks be making growth, so that the bark may slip e otherwise the buds will not "take" so well. It is also very important th

Fig. 16 – The bud as cut from the limb.

peration be performed at the proper time. If performed too early, when the ocks are in a thrifty growing state, the formation of new wood will surround nd heal over the wound or incision made in the stock, covering many of the uds, and many instead of remaining dormant, will start, making only short illowy shoots, which in spring start late, and do not make the best of trees. he stocks should also be budded before they have ceased grow, because then the bark tightens, and a bud that s to be forced under the bark often fails to "take," and ose that fail cannot be again budded that season—the me for successful operation having passed. The growth the stocks should be watched, and the stocks budded fore they have ceased to grow; but by this it must not inferred that very early budding is preferable, excepting hen the buds are to be started, to make what is commonly lled June buds. Stocks finishing their growth early in e season are budded early, and stocks that grow until tumn are budded late. The buds must be perfectly veloped. Undeveloped buds remain dormant in the ocks, and do not start even with the rest, and as they do t start until they have developed, sometimes not until e in summer, they make but very little growth the first ason. For early spring budding, the maturity of the ds is hastened by pinching the tips of the shoots of the es from which they are to be gathered, the buds being ken from the trees just before they start the second time. this way a soft shoot is made to harden, and its buds fit for early budding in ten or twelve days. If a con- erable quantity are wanted, they are stripped of their leaves and packed moss or wrapped in dampened sacking immediately after being cut, and t away for future use. They can thus be kept for two or three weeks.

Fig. 17.—Bud inserted.

Almond, Apricot, Cherry.

Almond.—See method of budding the peach; it is the same for the almond.

Apricot.—See peach; the same for apricot.

Cherry.—The method pursued in budding the cherry is very similar to the thod employed on the peach. Mazzard seedlings, for standards, are dded in July and August, and left to lie dormant through the winter, to started in the spring following. Morello and Mahaleb seedlings, for arfs, are best budded in August. They are somewhat more difficult to ke "take" than the Mazzard, and the operation is best performed when stocks just begin to relax in growth.

Chestnut.

The chestnut is very successfully budded in the summer during the owing period of the stock. The following illustrations show the size the d is cut, the cut in the stock, and the bud as inserted and tied:—

The slit or incision in the stock is made first; then the bud is cut from budding stick, and immediately inserted into the slit or incision in the ock, and tied tightly with soft cotton twine. In three weeks the strings y be removed, and the buds left to lie dormant until spring, when the ps of the stocks are cut back in March to force the buds to start. The

operation is best performed in August, when the stocks are making gr
and better still when they are just hardening the growth in the latte

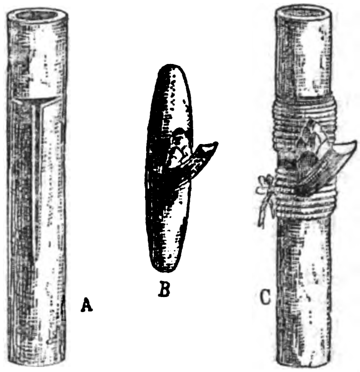


Fig. 18.—A The stock showing the incision made to receive the bud. B The bud, showing the
of same, and manner in which it is cut. C Bud inserted, showing method of ligature.

of August. The chestnut is also budded successfully by the ring me
as described for the fig.

Citron.

See method of budding the orange; it applies to the citron also.

Fig.

The fig is perhaps the most difficult tree to bud. The milky subs
that exudes from the limb or bark seems to sour and poison the sap w
comes up from the stock, and preven
bud from uniting, and for this reaso
methods of budding as employed o
peach, pear, &c., cannot be used on t
For the fig, the best method is to
ring right around the stock, as shown
figure at A (say) from three-fourths
inch to an inch long. Then another r
bark is taken from a limb (the scion),
same size, having the bud wanted, as s
in the figure at B. This is then slippe
the cut in the stock, and bound tightl
the soft cotton twine or cloth, covering
to exclude the air. By this metho
ascending sap will unite with the sap of the bud. The operation shou
performed in August or September.

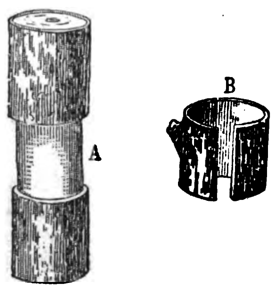


Fig. 19.—A The stock prepared.
B The bud.

Lemon and Lime.

Lemon.—See method for budding the orange; it is the same for the le
Lime.—See method for budding the orange; it applies to the lime al

Olive.

Budding the olive by the ordinary methods is somewhat difficult.
methods herein given are the most simple and the most practiced.
plate bud is the one most largely used. This is one of the most simp

l methods of budding the olive, and can be operated on small and large
ees. A cut is made on the stock, thus ⊓, and the flap drawn down. The
ud is then cut from the scion to be a little smaller than the space cut in
e stock; it is then inserted, as shown in Fig. 21. The bud consists of
ly the bark and an eye. At every leaf there is a bud, and the bark being
it around it, separates very easily from the wood. The flap is then turned
), covering the bud entirely, and is tied tightly with good, soft cotton

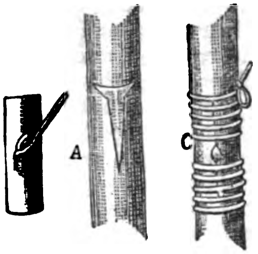


Fig. 20.

Fig. 21.

Fig. 22.

Fig. 20.—A Incision (ordinary budding) in the stock. B Plate bud. C Bud inserted and tied.
Fig. 21.—Plate bud inserted; front view, showing flap, which is turned upwards and then tied.
Fig. 22.—Bud inserted and covered with the two flaps from above and below, and is known as the "H" method.

ine. In three weeks or a month the strings must be removed, and
dling the tree about an inch or two above the bud will induce the bud to
rt. After it has commenced to grow well the top of the tree may be cut
ay a foot above the bud, and the bud trained to the stock.

Fig. 24.

Fig. 23.

Fig. 23.—Twig bud, showing how it is trimmed and removed from the branch.
Fig. 24.—A smaller twig bud, showing how the wood in the bud is gouged out.

Another very simple operation consists in making a cut in the stock in
e form of an H. The flap is then drawn both ways, up and down, from
e centre out, and the bud inserted, the flaps protecting both ends of the
d, as shown in Fig. 22. This method has the advantage that large buds,
ving a large bulge at the leaf part, can be used, while they cannot in the
gle-flap method. The other figures (Fig. 20) show how the buds are
noved and inserted by the ordinary plate method.
The twig bud is also very simple, but requires more skill and care.

By this method the cut is made deep into the wood to give the l sufficient bark, as most the wood in it is afterwards removed. The lea are partly cut off, leaving at least a ½ inch of the leaf on the bud prevent the bud from drying; then, with the sharp point of the buddi knife, the greater part of the wood inside the buc removed, as shown in Fig. 24. If part of the woo not removed then the bud cannot take, as the wooc it prevents it from uniting. The bud is then inser into the stock, as in the ordinary way, and tied tigh In three weeks the string is removed, and part of top of the stock is cut back to force the bud to st As the bud grows, the foliage of the stock is gradu removed, until the bud is able to take up the entire f of sap; it is then left to grow. This process is p formed at any time of the year when the sap flows fre Best results are, however, obtained when the buds are inserted early in spring of the year, as the operation can be performed to a much bet advantage, and the buds will grow to some height before the winter mon set in.

Fig. 25.—The bud severed from the stick.

Pear.

The pear is budded in the same way as the apple, and the operation is performed in like manner, excepting that the buds are cut sharper and not so long. Pear seedlings may be budded in July or August. The scions are taken from the trees of the current year's wood, the leaves trimmed off, and the bud inserted in the same way as the apple. Fig. 25 shows how the buds are trimmed of their leaves, and the size cut from the limb. The buds are cut all the way from ¾ to 1¼ inch long. Point A (Fig. 26) shows the length cut above the bud, and point B the length below it.

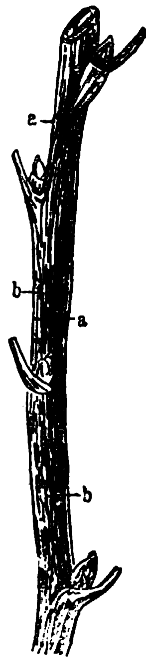


Fig. 26.—Budding sti showing the size bu are cut.

Plum.

The plum is budded during the months of July and August, and in some localities the stocks begin to relax their growth quite early. They should, therefore, be watched and budded before the bark tightens. The method for the plum is like that for the pear, and is performed in a like manner. Fig. 27 represents how the bud is cut from the stick, and the length. Many prefer to remove the wood in the bud, as they take better, but this is not necessary when the knife used is quite sharp and properly tied. For time of cutting back, starting the buds, &c., see pear, peach, &c.

Quince.

The system as explained for budding the pear will suffice for the quince.

Walnut.

The walnut is budded very successfully by the following method:—' bud is cut, as shown in Fig. 28, about 1½ inch long. The cut is made d into the wood, the object being to give the bud as much bark as possi

e wood of the bud is then partly removed. It is gouged out with the arp point of the budding-knife, as too much wood in the bud prevents a oper union. The bud is then inserted into the incision made into the ck, the same as ordinary budding is done. The bud must then be tied

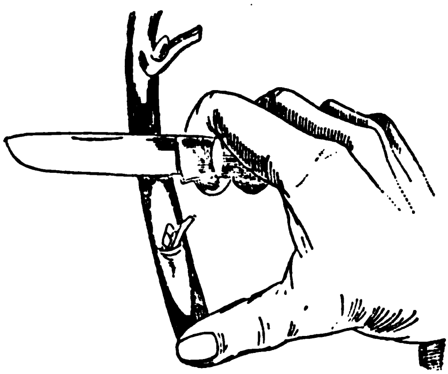


Fig. 27.

htly with heavy budding twine. In three weeks after the bud has been erted the twine may be removed, and the bud allowed to lie dormant til spring. The walnut does not put forth until late in the spring, there-e the stocks are not cut back till then. As soon as the buds of the stocks

Fig. 28

Fig. 29.

Fig. 28.—Size of bud and how cut.
Fig. 29.—Transverse view of the bud, showing how the wood, and how much of it, is gouged out.

gin to swell, the stocks are cut back, and the inserted buds allowed to ow. Great care must be exercised not to cut the stocks so close to the d as to endanger it. The buds are allowed to grow at will until they come hardy; then they are trained to the stock, the object in view being traight tree. The operation is performed in July and August, when the e is making its growth.

The Production of Beet Sugar.

THE production of sugar from beets has already formed the subj
articles in the *Gazette*. As, however, the matter is being approache
wider and more practical basis, it is thought that the reproduction
following bulletin, issued by the Perdue University Agricultural Expe
Station, will be of value, both to farmers desirous of growing suitabl
as well as those who may be interested in extracting the sugar.

SUGAR BEETS.

BY H. A. HUSTON,
Chemist, Purdue University Expt. Station—Indiana.

VARIOUS attempts have been made to establish the sugar-beet indu
America. A trial in Pennsylvania in 1830, and one in Massachus
1838–1839, completed the record up to 1863. In that year a facto
established at Chatsworth, Ill. After this location had been tried wit
results for six years, the factory was removed to Freeport, Ill., and on
later to Black Hawk, Wis., where the enterprise again failed. Other at
were made between 1870 and 1890 in Wisconsin, California, New J
Massachusetts, Canada, and Maine.* While these enterprises resul
failure, the lessons to be drawn from their history are of the highest
for the causes of failure are plain, and may be included under unfavo
soil conditions, bad water supply, unsuitable climatic conditions, an
business management.

In 1879 Mr. E. H. Dyer, of Alvarado, Cal., who had been interested
unprofitable attempt made there to manufacture beet sugar, organised
pany to manufacture beet sugar, using the same buildings and groun
by the old company. This company has been successful from the sta
is still manufacturing large quantities of sugar. Other factories hav
built at Watsonville, Cal., Chino, Cal., Grand Island, Neb., Norfolk,
and Lehi, Utah, and all these factories are meeting with good success.

It is important to note that the early attempts to establish factorie
made without first finding out whether beets of satisfactory quality co
grown at the points were the factories were built, while the factories
successful operation were located at points where field-trials showe
good beets could be raised.

These factories produced during the year ending 30th June,
27,083,288 lb. of sugar, an increase of 15,078,450 lb. over their prod
for the previous year.† This sugar was made from 128,887 tons of

* An interesting account of this early work, and the causes of its failure,
found in Dr. W. H. Wiley's Bulletin No. 27, Chemical Division, U.S. Depart
Agriculture, 1890.

† Report Commissioner Internal Revenue for fiscal year ending 30th June, 189
Bounty on Sugar.

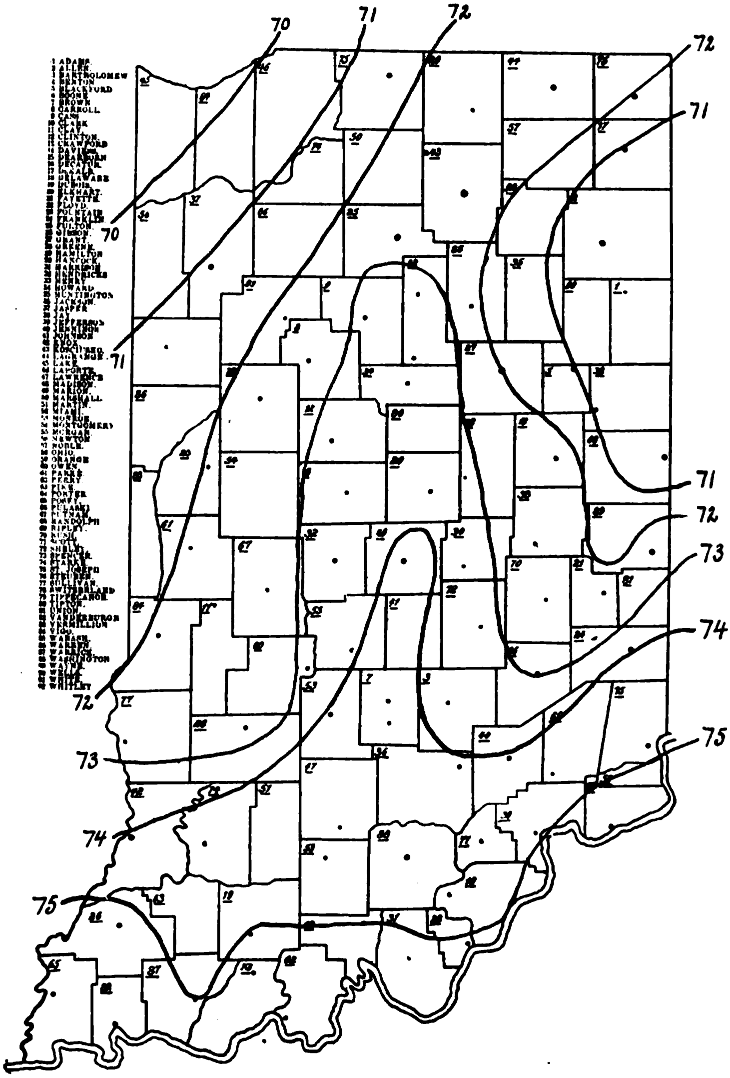


Fig. 1.

Lines of equal temperature for June, July, and August. Mean temperature.

(11b 78-94)

ed on 13,128 acres of land. Returns for the crops raised in 1893 are not available, but there were reported under cultivation in beets 24,793 acres, n which it was proposed to make 57,200,000 lb. of sugar. It will be n that the increase during the past three years is very rapid, an indication those engaged in raising sugar-beets find the business profitable. The l success of the sugar-beet industry in California, and its success from start in Nebraska and Utah, has aroused new interest in the subject, and experiments have been undertaken in nearly every northern state for purpose of testing the adaptability of their soils and climate for sugar- culture.

n view of this renewed interest in the subject, it may be well to sum- ize the conditions required for success in the sugar-beet industry.

Agricultural conditions.

limatic conditions have always held a leading place in deciding on the tion of beet-sugar factories. The usual standard for temperature is, that average temperature of the three summer months should not exceed 70 rees Fahrenheit. A belt, 100 miles wide, on each side of a line passing ugh the points, having a mean summer temperature of 70 degrees, was posed to practically include the sugar-beet belt. This belt, as originally down, included the northern half of Indiana, and gave a nearly straight across the state; while the line drawn by using the data of the Indiana ather Service from all available points in the state has a totally different n, the line making a very marked bend to the north. (*See* fig. 1). The peratures of September, October, and November are also important ors.

he rainfall is a most important element in the case. Enough rain is ired in April and May to insure proper germination of the seed. The mer rainfall must be enough to maintain the steady growth of the plants. ainfall that will carry the corn-crop through the summer in a satisfactory dition will provide for proper growth of beets. The beets should show s of maturity here about the middle of October,* and a small rainfall in ober and November favours the ripening of the beet, and its richness in r, and the purity of its juice. A warm, moist autumn tends to produce cond growth of the beet, which results in a reduction of the purity of the e.

he following table, compiled from the records of the Indiana Weather rice, gives the average temperature and rainfall of the three sections of state:—

TABLE I.

Location.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mean temperature. Degrees Fahrenheit.												
hern counties	22·9	27·4	34·2	49·7	59·6	70·6	73·9	70·4	64·3	50·9	38·3	30·7
al "	25·8	30·8	35·9	51·7	61·4	71·9	74·9	70·9	65·5	51·9	40·0	32·7
hern "	29·7	34·6	40·8	55·2	63·4	73·5	75·7	73·8	67·0	54·4	43·2	35·7
Rainfall, inches.												
hern counties	2·52	2·90	2·52	3·24	4·70	4·15	2·86	2·75	3·14	2·16	3·39	2·47
al "	3·25	3·43	2·77	3·86	4·31	4·04	2·88	3·41	3·29	2·08	3·09	2·88
hern "	3·78	4·48	3·62	4·39	4·09	4·33	3·20	3·91	3·60	2·25	4·35	3·15

* About April in Australia.

While this table gives a general view of the climate in the three secti of the State, the division is purely arbitrary, and there are as wide variatio in temperature between different counties in the same section as betw different sections. This is due to the influence of the Ohio and Wab valleys on one side and to the great lakes and the lower Michigan penins on the other. From this peculiar combination it results that Logansp Indianopolis, and Vevay (at the extreme south-eastern point of the Sta have the same mean temperature for July as shown by the records extend from twenty-two to thirty-eight years. For the three summer months mean temperature for the northern section is 71·6 degrees, of the cent 72·5 degrees, and for the southern 74·3 degrees. The mean annual rain for the northern section is 37·1 inches, for the central 39·7 inches, and southern 45·0 inches. This excess for the southern counties is distribu over every month of the year except May. In May the rainfall is great in the northern counties, but the amount in all sections is ample for c purposes. So far as the beet crop is concerned, the higher rainfall in southern sections during July, August, and September would more th compensate for the somewhat higher temperature, while the lower rain of October in all sections is favourable to the ripening and harvesting of crop. The temperature of the winter months in the central and south sections is favourable to continuing the manufacture of sugar after beets are harvested.

Soil.—Moderately light sandy loam is the soil generally considered b for beets. Heavy clay does not permit the tap root to penetrate the subs Muck lands give badly formed beets with impure juices, owing to excess nitrogen compounds and poor drainage. Good results are most likely to obtained on lands that have been under cultivation for ten years or mo and which give good crops of corn and wheat. The black prairie soils wh have not yet been reduced to good condition for wheat are not desirable beets, since they contain too much soluble mineral and nitrogenous mater and produce a rank growth of beets with impure juice.

A deep soil that can be put into a mellow condition by deep plough and subsoiling is most likely to give good returns.

If the land is thought to be in need of manure it will be best to appl heavy dressing of barnyard manure to the previous crop rather than ap it to the beet crop. But when this is impracticable the manure should applied in the fall and ploughed under. If commercial fertilizers are to used phosphates seem to claim the first place, and for nitrogen compou nitrate of soda is most desirable, but the amount per acre should not exc 300 lb. Both should be applied before seeding. Later applications nitrate of soda prolong the growth of the plant and delay ripening. Th is no doubt but there are extensive areas of land well adapted to sugar-b culture to be found in all sections of the state.

Factory requirements.

Of course, the most prominent of these is a supply of beets. This m depend on suitable soil and climatic conditions, and then on an inclinat on the part of farmers to furnish beets to the factory. The kind of farm required to produce good crops of beets is very different from the kind n in vogue in producing wheat and corn. But the very rapid increase acreage of beets in the territory near the present factories would indic that farmers had found beet raising more profitable than grain raising.

Factories need large quantities of water of good quality for steam-making l extracting of sugar from the beets. Large quantities of limestone are d in the process of sugar manufacture, and the consumption of fuel is ge. *The Norfolk* (Neb.) *News* states that up to 1st December the Norfolk tory had paid 31,000 dollars for *freight* on coal.

ndiana can furnish an abundance of cheap fuel, coal, gas or oil; its waters of suitable quality, and it has abundance of limestone. Markets are close hand, and transportation facilities abundant. *The Norfolk News*, under e of 27 December, 1893, in speaking of the beet industry, says: "The t sugar factory up to the present time has turned out nearly 4,000,000 lb. fine granulated sugar—double the amount produced last year. This ar was all manufactured from this year's crop of beets, and does not ude sugar made from the syrup that the factory is now working up. en the syrup on hand is reduced, the output of the factory for the cam- gn will amount to considerably more than 4,000,000 lb. This industry is three years old, but if it increases in the next three years in the same portion it has in the past, it will be necessary to enlarge the capacity of factory in order to handle the supply of beets. . . . The success of beet culture, the enormity of the crop, and the price paid for beets at factory demonstrates that there is more money—a greater profit to the ner—in 1 acre of beets than in 6 to 7 acres of corn. Many farmers und Norfolk realised a profit of from 25 to 55 dollars per acre on their t crop this year, and some report the amount even higher. When a man s in an acre of beets the factory contracts for the entire crop when it is n, agreeing to pay 5 dollars per ton."

. factory for the manufacture of beet sugar, capable of handling 350 tons beets per day, would cost about 400,000 dollars, and ought to receive the s from 2,500 to 3,000 acres. The beets should contain not less than per cent. of sugar.

Method of raising beets.

Ploughing.—It is of the highest importance that the land intended for s should be ploughed deeply enough to allow the beet to develop its nal shape and still not protrude above the ground. Where the subsoil ot very light it is necessary to stir the ground to a depth of 15 inches. best way to accomplish this is to plough the land 6 to 8 inches deep n an ordinary plough. It is not desirable to turn up a thick layer of soil that has not been disturbed before. The ordinary plough should be owed by a subsoil plough working in the furrow and loosening the soil 9 inches below the bottom of the furrow. The Moline subsoil plough wing appears in *Agricultural Gazette*, vol. iii, p. 775, Ed. A.G.), is recom- ded for this purpose. It does not turn the soil, but loosens it. It does bring a heavy layer of raw subsoil to the surface but leaves the subsoil position, but in such a condition that air and water readily penetrate it, the tap root of the beet can easily make the required downward growth. s essential that the soil be so prepared that this downward growth can e place, for otherwise the beet root will extend above the ground; all that part of the root above ground is worthless for sugar-making, l must be removed when the beets are topped.*

* Many of the beets grown in this country sent to the Department showed this failing.—Ed. A.G., N.S.W.

It is generally recommended that this ploughing should take place
fall. This is especially necessary if stable manure is to be applied. If
manure be applied in the spring it usually causes a rank growth of
which have a low sugar content and impure juices, owing to delay in rip
Even when stable manure is applied in the fall it should be well rotte

Little has been done in America in experimenting with comm
fertilisers on beets. Such experimental facts as have come und
observation seem to indicate that the results obtained did not justify t
involved. Yet the question is a local one depending on the natu
present fertility of each soil and on the amount and distribution
rainfall.

Seeding.—The land should be harrowed deeply in the spring
thoroughly prepared seed-bed made as soon as the condition of the
will permit. For this state the planting time should be from 1st A
15th May.* The rows should be from 18 to 24 inches apart, accord
the richness of the soil. The richer the soil is the closer the rows sho
This closeness of the rows on rich soils will prevent the growth of larg
containing little sugar.

Fifteen pounds of seed to the acre is a fair amount. On the Statio
the seed was drilled in with a Planet Jr. hand drill. The ground sho
given flat cultivation to keep down weeds until the plants have dev
four leaves.

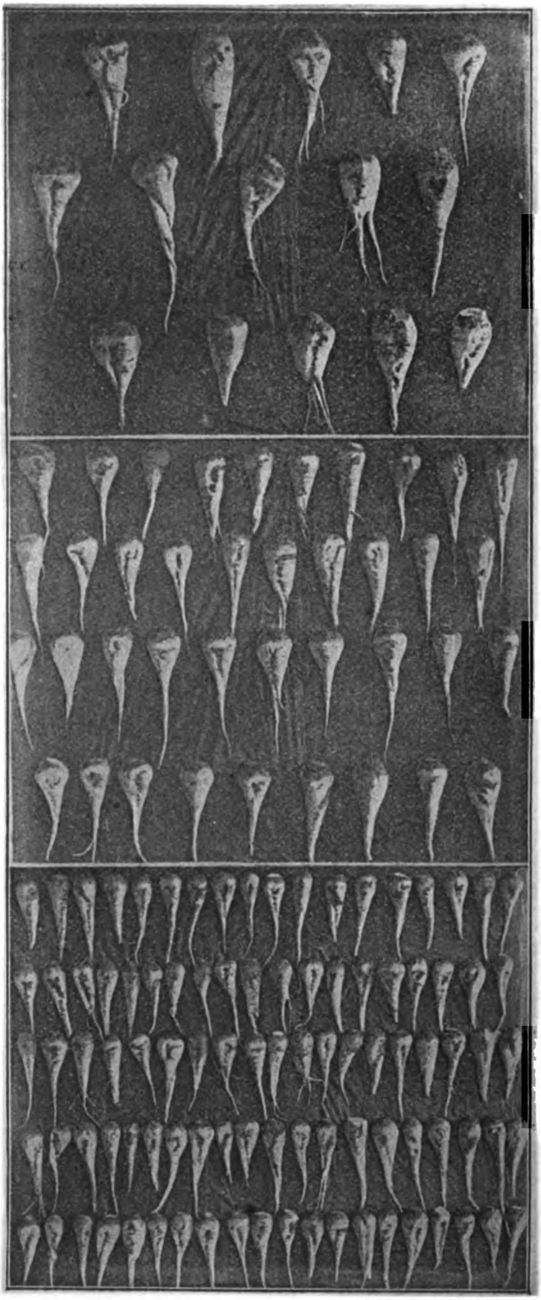
Thinning and cultivation.—When the plants have developed four
they should be thinned out so as to stand 6 or 8 inches apart in the
This should be understood to be the average distance between the
The most vigorous plants should be left, even if the distribution in th
is somewhat uneven. This work of thinning requires care and consi
hand-work, and is the work that is most objected to on the part of fa
By using a hoe with a blade 4 inches wide much time was saved in th
plants on the Station plats. Cuts across the row were made every 6
with the hoe, and the remainder of the work of removing wee
unnecessary beet plants done by hand.

After thinning, the ground should be cultivated often enough to kee
weeds and maintain a mulch of loose earth, until the plants are large e
to shade the ground well. At the last cultivation it may be well to
the earth towards the rows if the roots exhibit a tendency to extend
the ground.

Harvesting.—Two methods of harvesting beets are used. In one t
and crowns of the beets are first removed by a sharp hoe of speci
struction, and then the roots are removed from the ground by ploughi
or by pulling, or by a special tool drawn by horses, constructed somew
the principle of a potato digger. In the other method the roots ar
removed from the ground and the crowns and tops removed by a heavy

It is generally stated that the beets are ready for the harvest wh
leaves change in colour from the dark green to a yellowish green, a
outer circles of leaves bend down forming a ring of leaves about th
Although beets have been left in the ground until the end of Decem
have never seen them exhibit these signs of ripeness, and the amount of
in the beet is the better guide. I would not advise harvesting befo
November.† Tables showing the condition of beets at different dat
be given later on.

* October and November, in Australia. † May in Australia.



15 LARGE BEET
WEIGHT, 40 LB.
CONTAIN 4 LB. OF SUGAR.

39 MEDIUM BE
WEIGHT, 40 LB.
CONTAIN 4 LB. OF SUGAR.

96 SMALL BEET
WEIGHT, 40 LB.
CONTAIN 5 LB. OF SUGAR.

FIG. 3.

Special tools.—Special tools have been devised for nearly every operation involved in raising beets. The only ones that are necessary for experimental work, involving from 1 to 5 acres of beets, are the subsoil plough, the usual selling price of which is 13 dollars, and a good hand-drill to plant the seed. Both of these implements are of value for use on other crops. Reports from California indicate that the removal of the beets from the ground by horse-power is successful.

Size and yield.—It is not desirable to raise large beets. Those weighing from 1 to 2 lb. are considered best for sugar-making, and factories generally refuse to take beets weighing over 4 lb. The reason of this is that very large beets contain relatively little sugar, and a relatively large amount of soluble matter not sugar, which makes the extraction of the sugar from such beets unprofitable. The size of the beets is kept down by thick planting. The average yield per acre for California, Nebraska, and Utah, in 1892, was 9·8 tons of topped beets per acre, 10·5 in California, 9·0 in Utah, and 7·8 in Nebraska. The season in Nebraska was unusually dry, which in part accounts for the light yield there. From the tonnage per acre, it would appear that the average weight of the beets are only about one-half pound. Small beets, however, are richer in sugar than large ones, as is shown in fig. 3, and in this respect the beet crop has an advantage over most other crops. For, while a short corn crop, due to drought, gives corn of poor quality, a short beet crop due to the same cause will give beets of better quality, for which an increased price may be obtained.

Side products.—The crowns and tops of the beets have a high feeding value for stock. After the sugar is extracted from the sliced beet there remains a pulp which was formerly used for fertilizing purposes, but which is now used to feed large herds of cattle kept near the factories. The lime refuse from the factories is also used as a fertilizer, although its usefulness must depend largely on the physical condition of the land.

Indirect advantages.—The culture of the sugar beet cannot be carried on continuously on the same land, but the beet crop must be one of a series of crops in a rotation. The benefits of a system of crop rotation are becoming so well known as to require no further notice here. The subsoiling and special cultivation absolutely necessary for the beet-crop extend their benefits over the whole rotation, and in countries where the beet industry has been established the crop-producing power of the soil has been notably ncreased without the use of additional quantities of manures. This effect of deep tillage will be especially noticeable on lands that have been long used for corn and wheat, and have received the customary hallow ploughing. The observations on increased crop following beet ulture relate principally to the wheat crop. Experiments conducted in ndiana on deep ploughing for corn show that it produces a marked ncrease in crop, although the increase may not appear until one winter as passed after the deep ploughing.

Results in Indiana during 1893.

The season.—The conditions of the weather were unusual and in most ections of the state very unfavourable. The following table gives the verage weather conditions of the state for twelve years for the growing eason, the conditions during 1893 and the departure from the average.

TABLE II.

Months.	Temperature.				Rainfall.		
	Average.	1893.	1893. Above average.	1893. Below average.	Average.	1893.	1893. Above average.
April	52·2	52·4	0·2	...	3·82	8·46	4·64
May	61·4	60·0	...	1·4	4·40	4·46	·06
June	71·9	71·9	0·	0·	4·25	3·45	...
July	74·6	77·9	3·3	...	3·13	1·83	...
August	71·5	72·3	0·8	...	3·08	1·02	...
September	64·9	68·2	3·3	...	3·13	3 31	0·18
October	53·2	54·4	1·2	...	2·55	3·53	0·79
November	40·9	40·2	...	0·7	3 82	2·99	...

It will be noticed that the temperature for July, August, Septemb
October was unusually high; the high temperature and excessive rai
October were especially bad, as they caused a second growth of the be
prevented ripening and storing up of sugar. The rainfall in April
highest on record for forty years, while the very low rainfall of June
and August did serious damage to all crops. The August rainfall in n
counties is the lowest on record; in the central and southern count
lowest occurred in 1889.

November was favourable to the ripening of the crop for the fi
weeks, but the last half of the month was unusually cold, and in the
and northern counties beets could not be left in the ground aft
fifteenth, although in ordinary years they would be safe from frost u
end of the month.

Taken altogether a more unfavourable set of weather conditions
been experienced for thirty years.

Seed sent into every county.—Early last spring the station furnish
beet-seed, of the best quality, to 167 farmers, seed being sent to every
in the State. Most of the parties to whom seed was sent had sent a
for it; but in a few cases seed was sent with a request that the
would raise the beets in order to make the list of counties complete.

From these 167 farmers twenty-six samples were received and twe
reported failure, either from drought or insect attacks, while a few
plant the seed owing to heavy spring rains. From 120 farmers
whatever has been received to the letters asking them to report su
failure. The sample called for ten beets of average weight of th
The information called for appears on page 499, which is a reproduc
the blank sent beet growers.

PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION, LAFAYETTE, IND.

Form for Description of Sample Sugar Beets.

oratory No. Received at Laboratory

ach sample of beets sent for gratuitous examination must be raised according to ctions of seed package and must be accompanied by one of these forms, with proper ıks below filled out fully and legibly. The filled out form, if enclosed with the ple, will serve as a label.

Date of taking this sample

Date of shipment.

Crop grown on ground the preceding year

Character of soil

How deep was the ground ploughed?

Exact area of plot planted

Variety of seed sown

Date of planting

How long before the plants came up?

Distance between rows

Distance between beets in a row

When did you thin out?

How many times did you use cultivator?

How many times did you hoe?

Give date of hoeing

Give exact area of plot harvested

Number of pounds of beets raised on this plot

Number of beets on plot harvested

What fertiliser, if any, used

Date of harvesting

Entire cost

Do you think from your experience of this year that you could afford to grow beets at 4 dollars per ton?

nty Post Office

Sign here

nples should be shipped before November 15.

As a rule the blanks were better filled out than in previous years. This especially true in regard to weight and number of beets harvested, and to e area of the plat.

The mere analysis of a sample of beets is of little interest or value unless e fullest information in regard to cultural conditions and yield is rnished.

The results of the analyses of samples from all parts of the State are given table III, pages 500 and 501. The analyses of the beets harvested at the ation on 2nd November are also included for purposes of comparison.

Table III.—Results of Anal

Name.	Post Office.	County.	Variety.	Average weight.
				oz.
Herbert Ashton	Babcock	Porter	Kleinwanzleben	33·3
E. L. Furness	Furnessville	,,	,,	28·1
,,	,,	,,	Knauer	12·4
,,	,,	,,	,,	13·2
J. H. Little	Lowell	Lake	Kleinwanzleben	7·6
W. J. Besson	Mentone	Kosciusko	,,	15·3
W. J. Hand	Marmont	Marshall	Knauer	17·7
,,	,,	,,	Desprez	13·3
M. A. Eisenhorn	Inwood	,,	Vilmorin	6·4
A. M. Taylor	Thurman	Allen	Kleinwanzleben	14·6
,,	,,	,,	,,	15·8
John Sprankle	Fort Wayne	,,	Knauer	23·9
H. V. L. Garrett	Liberty Centre	Wells	Kleinwanzleben	20·2
John L. Paullus	Treaty	Wabash	Knauer	4·4
John Kulb	Lincolnville	,,	Vilmorin	7·9
Lewis C. Sheppard	Carlos City	Randolph	Knauer	16·5
Snead Thomas	Marion	Grant	Kleinwanzleben	9·4
M. M. Moody	Selma	Delaware	Desprez	15·0
W. P. Gates	New Lancester	Tipton	Kleinwanzleben	5·8
W. A. Maze	Sharpsville	,,	Vilmorin	18·5
E. M. Smalley	Shannondale	Montgomery	Kleinwanzleben	12·7
J. G. Kingsbury	Irvington	Marion	,,	16·6
C. F. Muth	Morristown	Shelby	,,	10·2
T. J. Moss	Ashboro	Clay	Vilmorin	21·7
A. W. Butler	Brookville	Franklin	Kleinwanzleben	11·6
,,	,,	,,	,,	18·0
C. D. Faris	Bloomington	Monroe	,,	18·5
H. S. Nowlin	Lawrenceburg	Dearborn	Vilmorin	8·0
Will Bunger	Patriot	Switzerland	,,	25·6
U. M. Stewart	Madison	Jefferson	,,	15·3
E. W. Fisher	Corydon	Harrison	,,	7·1
Agr. Exp. Station	La Fayette	Tippecanoe	Bul. Desprez Richest	7·3
			F. Desprez Richest	7·0
			Kleinwanzleben	6·6
			S. Le Grand Im. White	4·9
			Vilmorin	6·0
			Imperial	5·4
			Red Top	7·6
			Knauer	6·6
			Vilmorin	3·6
			Kleinwanzleben	3·6
			,,	6·2
			Knauer	6·9
			Desprez	6·5
			Vilmorin	6·4
			,,	6·7
			Knauer	8·0
			Desprez	5·7
			Kleinwanzleben	6·9

aised in Indiana during 1893.

Soil.	Tons per acre.	Depth ploughing.	Distance between rows.	Date of planting.	Date of harvest.	Per cent scab.	P. c. bacterial disease.	Previous Crops.	Profitable at $4 per ton.	Remarks.
		in.	in.							
dy ...	21	8	18	8 May	17 Oct.	30	0	Corn ..	No	Injured by drought, blister beetle, and second growth.
m ...	...	6	18	6 ,,	23 ,,	50	12	Garden ...	Yes	
(chip manure).	...	6	18	6 ,,	23 ,,	10	10	,, ...	,,	
manure)	...	6	18	6 ,,	23 ,,	20	0	,, ...	,,	
... ...	16	8	18	20 ,,	17 Nov.	20	0	Pasture ...	No	Injured by b.b.
dy loam	14	8	20	18 ,,	26 Oct.	0	0	None ...	,,	
	...	...	...	......	......	0	20	....		
	...	...	...	......	......	0	0	....		
... ...	5	10	18	4 May	4 Nov.	33	6	Beets and carrots.	,,	
... ...	...	15	30	20 April	20 Oct.	0	0	Beets ...	,,	Injured by moles.
... ...	...	8	30	20 ,,	20 ,,	16	0	,, ...	,,	
... ...	11	7	36	1 June	1 ,,	0	0	Turnips ...	Yes	
dy loam	16	10	18	1 ,,	1 Nov.	0	0	Potatoes.		
dy loam	5	8	36	6 May	26 Oct.	0	20	Rye ...	No	
... ...	11	8	18	8 ,,	27 ,,	0	30	Potatoes ...	,,	
dy black	26	10	18	31 ,,	23 ,,	40	0	Clover ...	Yes	
... ...	21	10	15	10 ,,	19 ,,	25	0	Potatoes ...	,,	
... ...	7	9	36	13 ,,	16 ,,	20	30	Corn and melons.	No	Imperfect stand; injured by b.b.
n ...	...	8	23	17 ,,	1 Nov.	35	0	Corn ...	?	
lay ...	27	10	20	20 ,,	17 Oct.	20	10	,, ...	Yes	Injured by b.b.
m ...	18	8	20	20 ,,	7 Nov.	0	0	Potatoes ...	No	
	...	...	...	......	......	100	...	....	...	Beets considerably wilted.
	...	...	18	......	......	66	...	....		
	...	...	...	......	......	50	0	....		
... ...	...	11	36	3 May	15 Nov.	0	0	Beans.		
de ...	...	11	36	17 June	14 ,,	0	0	Corn.		
loam...	4	12	21	20 May	2 ,,	30	0	Hay ...	No	Imperfect stand; injured by b.b.
n ...	5	14	22	19 ,,	1 ,,	0	0	Timothy ...	,,	Injured by b.b., and g.h.
...	28	9	20	15 ,,	6 ,,	0	0	Sweet Potatoes.	Yes	Injured by b.b.
loam ...	21	9	15	22 ,,	2 ,,	50	50	Potatoes ...	,,	
...	...	12	20	20 ,,	1 ,,	...	...	Corn ...	...	Beets made no growth before 10th Sept.
	9	14	18	7 April	2 ,,	37	6	Tomatoes ...	...	
	8	14	18	7 ,,	2 ,,	18	4	,, ...	...	Seed raised on station farm.
	6	14	18	7 ,,	2 ,,	28	0	,, ...	...	
	6	14	18	7 ,,	2 ,,	21	2	,, ...	...	
	6	14	18	7 ,,	2 ,,	23	0	,, ...	...	
	9	14	18	7 ,,	2 ,,	23	23	,, ...	...	
	8	14	18	7 ,,	2 ,,	23	12	,, ...	...	
	8	14	18	7 ,,	2 ,,	25	5	,,		
	6	14	18	7 ,,	2 ,,	13	8	,,		
	6	14	18	7 ,,	2 ,,	10	5	,,		
	9	14	18	4 May	2 ,,	50	2	Beans.		
	8	14	18	4 ,,	2 ,,	63	1	Onions.		
	7	14	18	4 ,,	2 ,,	31	1	Melons.		
	8	14	18	4 ,,	2 ,,	27	2	Potatoes.		
	5	14	18	24 ,,	2 ,,	24	0	,,		
	8	14	18	24 ,,	2 ,,	26	1	,,		
	6	14	18	24 ,,	2 ,,	15	3	,,		
	7	14	18	24 ,,	2 ,,	12	3	,,		

Explanations and remarks on table.—The "degrees Brix" means th reading of a special instrument for taking the density of the beet juice. Th actual densities were taken with a Westphal balance and calculated degrees Brix. The purpose of this part of the work is to get the data f calculating the relative purity of the juice. The purity of juice means th percentage of sugar contained in the solids of the juice. It is obtained l multiplying the percentage of sugar in the juice by 100 and dividing by th degrees Brix. The degrees Brix are supposed to represent approx mately the per cent. of total solid matter in the juice. If all th solid matter were sugar this would be true. But where solids other tha sugar are present it is only approximately true. Hence the result in th purity column is the apparent purity. The absolute purity of the juice ca only be found by drying and weighing the total solid matter of the juice an dividing 100 times the sugar percentage by the percentage of solids so foun This is too tedious for ordinary work, and so the apparent purity is use It can be compared with purity as usually reported in other writings.

In nearly all sections the growth of the plants was suspended during t months of July, August, and the early part of September. When the rai came the plants took on a new growth which was not finished at the ti when most of the samples were harvested. In view of the state of the pla at harvest the amount of sugar and purity of the juice is better than w expected. Provided the beets are of fair size, the higher the amount sugar and the purity the better. Beets containing 12 per cent. of sugar a purity of 75 can be worked at a profit with the modern machinery. Mo than two-thirds of the samples received come up to this standard. Th result is certainly encouraging in view of the extremely unfavourab conditions during the growing season.

A record of the amount of scab and bacterial disease observed was ke and the amounts found in samples received were the same as last year. T previous crop seems to have little influence on the amount of scab. On t Station plats the amount of scab was somewhat greater and the amount bacterial disease much less than last year.

In judging of the result the average weight of the beets, the sugar conte and the purity should be kept in view. It should be kept in mind that t tonnage is calculated from small plats, and so is only approximate. T tonnage is also for beets with tops removed, but the crowns not remove It was believed that better comparative results could be secured in th way than to have the crowns removed by persons not accustomed to t work.

Injury from Insects.—Much damage was reported caused by the blist beetle (*Epicauta marginata*, Fabr). Two broods appeared on the Statio plats, but were readily destroyed by an application of arsenite of ammon using 1 oz. of the strong solution to 3 gallons of water. Probably a mo dilute solution would do the work with less risk of damage to the folia As the insects generally invade the plat at one side, it is not necessary treat the whole field of beets, but only that part on which the insects a working, and a narrow belt of beets lying in the direction toward which th insects are working. It is well to begin on this narrow belt first and wo toward the part already effected by the insects. In this way the insects a driven backward rather than toward the part of the field not yet attacke Great care should be observed in using arsenite of ammonia. *It is the mo poisonous of all insecticides, since the arsenic is present in large quantitie and is all in solution.*

t should be noticed that in stating whether the beets could be grown at a fit of 4 dollars per ton, the grower was asked to base his opinion on his son's work.

Results obtained on the Station farm.—The soil of the station farm is lerlaid with loose gravel to a great depth, and hence is particularly sustible to injury from drought. This season the corn crop of this farm a failure, the yields being from 2 to 26 bushels per acre on different ts of the farm. In a favourable season the land will raise 70 bushels acre.

he weather record for the growing season appears in table IV. The rage is derived from continuous observations for fourteen years.

TABLE IV.

Months.	Temperature, deg. F.				Rainfall. Inches.			
	Average.	1893.	1893. Above average.	1893. Below average.	Average.	1893.	1893. Above average.	1893. Below average.
il	50·4	50·3	......	0·1	3·86	9·65	5·79	......
... ...	60·7	58·0	......	2·7	4·96	3·03	......	1·93
e	70·9	71·6	0·7	......	4·68	1·93	......	2·75
... ...	74·3	77·7	3·4	......	3·38	1·10	......	2·28
ust	71·8	72·3	0·5	......	3·21	0·77	......	2·44
ember ...	65·0	67·4	2·9	......	2·44	2·74	0·30	......
ber... ...	51·7	54·3	2·6	......	2·44	1·57	......	0·87
ember ...	38·2	38·5	0·3	......	3·32	2·42	......	0·90

he beets made practically no growth from 1st July to 25th September.

he following points were under investigation:—

Effect of time of planting.

Effect of time of harvest.

Effect of manure.

Sugar contents of smooth and scabby beets.

Effect of loosening beets some time before removal from the ground.

Test of varieties.

Home grown and foreign seed.

ll the beets raisen were small, as will be seen from the average weights en in table III. It is noticeable that the Knauer variety, which has in mer years given the lowest average weight, gave the highest average ght this year.

Time of planting and harvest.—The results of the experiments on time of nting and harvesting appear in table V, page 504. The beets planted on h May were badly formed, owing to the soil having become so hard on ount of drought.

he harvest of 5th October found the beets just starting a second growth. e results show that there was an increase in the size of the beet, but that relative amount of sugar decreased during October, and the purity was uced. During the first half of November the beets gained in size and in ar, but the increase in solids not sugar was also considerable. The hest purity was found at the first harvest before the effect of the second wth had shown itself.

TABLE V.—Date of Harvest.

Variety.	Date of planting.	October 5.			October 18.			November 2.			November 15.		
		Degrees Brix.	Per cent. sugar in juice.	Purity.	Degrees Brix.	Per cent. sugar in juice.	Purity.	Degrees Brix.	Per cent. sugar in juice.	Purity.	Degrees Brix.	Per cent. sugar in juice.	Purity.
Vilmorin	April 7	15·4	13·1	85·1	15·6	13·3	85·2	16·3	14·4	88·3	16·1	13·5	83·8
Knauer	,, 7	15·4	12·9	83·7	13·5	11·0	81·5	14·8	10·5	69·9	15·9	12·9	81·1
Kleinwanzleben	,, 7	16·4	13·9	84·7	13·7	12·0	87·6	16·5	14·2	86·0	16·7	14·0	83·8
,, ...	May 4	14·9	12·0	80·5	14·0	11·6	82·8	16·7	14·0	84·1	19·0	15·5	81·6
Desprez	,, 4	15·2	12·7	82·9	13·3	10·8	81·2	16·7	13·7	82·3	17·0	13·5	79·4
Knauer	,, 4	15·2	12·8	84·2	12·8	10·5	83·9	15·8	13·1	82·9	16·9	13·8	81·7
Vilmorin	,, 4	15·3	13·2	86·3	13·8	11·1	80·4	17·4	14·2	81·6	17·7	14·1	79·6
Kleinwanzleben	,, 24	14·1	12·5	88·6	14·1	11·5	81·5	16·6	12·9	77·7	17·5	14·3	81·7
Desprez	,, 24	13·4	11·4	85·1	14·3	12·0	83·9	16·0	12·8	80·0	17·1	13·9	81·3
Vilmorin	,, 24	14·6	12·7	87·0	15·7	12·9	82·1	16·7	14·2	85·0	17·2	14·1	81·9
Knauer	,, 24	12·7	10·8	85·0	14·7	11·5	78·2	16·3	12·5	76·7	16·6	13·2	79·5
†Bul. Desprez Richest ...	April 7	13·6	12·5	91·8	14·1	12·0	85·1	15·4	12·2	78·0	16·2	13·7	84·5
†F. Desprez Richest ...	,, 7	14·6	13·2	90·4	14·4	12·5	86·7	16·8	14·8	88·1	17·1	14·6	85·4
†Kleinwanzleben... ...	,, 7	14·0	12·3	87·8	14·5	12·5	86·2	15·1	12·1	80 1	16·7	14·0	83·8
†S. Le Grand. Imp. White	,, 7	14·6	13·0	89·0	14·8	11·6	78·4	15·6	13·6	87·1	16·4	13·8	83·7
†Vilmorin	,, 7	12·9	11·6	90·0	14·2	11·8	83·1	15·6	13·2	84·6	14·1	11·2*	79·4
†Imperial	,, 7	12·2	11·0	90·1	13·9	11·7	84·2	14·0	12·3	87·9	15·6	12·5	80·1
†Red Top	,, 7	13·6	11·0	80·9	13·3	10·6	79·7	14·8	12·6	85·1	14·9	11·8	79·2

Effect of Manure.—The land intended for beets was given a light ploughing 1 the fall, and to the greater part of it was applied a moderate dressing of arnyard manure, containing considerable unrotted straw. This manure was ft on top of the ground until spring, and then the land was given a deep loughing and subsoiling, the manure being completely turned under. A rip of land 20 feet wide received no manure, but was given the same oughing as the other.

On the manured plat the stand of beets was perfect, but on the plat ceiving no manure the stand was very defective. Therefore, no attempt as made to compare the yields on the two plats. The plants were tended ike on the two plats and harvested 15th November. The table shows the sults obtained. Samples having the average weight were selected from e two plats, and the analyses of the samples appear in the same horizontal ie. Owing to the very imperfect stands, some of the beets on the unmanured at grew much larger than any of those on the manured plat, and the alyses and weight of these are also given. These larger beets were of sirable market size.

TABLE VI.

Variety.	Date of Planting.	Av. Wt.	Manure.			No Manure.		
		oz.						
lauer	April 7	9·7	15·9	12·9	81·1	15·6	12·3	78·8
"	" 7	16·8				15·1	12·9	78·8
einwanzleben	" 7	6·3	16·7	14·9	83·8	17·6	14·6	82·9
"	" 7	16·4				17·3	14·1	81·5
lmorin	" 7	7·1	16·1	13·5	83·8	16·2	14·1	87·0
"	" 7	14·4				15·8	13·0	82·3
einwanzleben	May 4	9·8	19·0	15·5	81·6	15·8	13·1	82·9
"	" 4	15·3				15·3	12·7	83·0
lmorin	" 4	9·5	17·7	14·1	79·6	15·8	12·5	79·1
"	" 4	19·6				16·3	13·2	80·9
sprez	" 4	11·3	17·0	13·5	79·4	15·5	12·7	81·9
"	" 4	10·1				15·9	13·6	85·5
auer	" 4	11·5	16·9	13·8	81·7	16·3	13·1	80·4
"	" 4	18·4				15·1	12·4	82·1
sprez	" 24	10·4	17·1	13·9	81·3	17·1	13·9	81·3
"	" 24	6·2				15·9	13·1	82·4
einwanzleben	" 24	7·1	15·5	14·3	81·7	17·5	14·2	81·1
"	" 24	3·2				18·0	14·7	81·7
morin	" 24	7·8	17·2	14·1	81·9	16·6	13·6	81·9
"	" 24	10·7				16·0	13·0	81·3
auer	" 24	9·7	16·6	13·2	79·5	16·9	13·5	80·0
"	" 24	4·7				16·7	13·7	82·6

While the comparison between plats having a full stand and those having imperfect stand is not a fair one, so far as we can observe from the results tained, the purity of the juice was not impaired by the use of the manure plied in the fall. The perfect stand is attributed to the use of the manure, ce the plats received similar treatment in every other respect.

Sugar Content of Smooth and Scabby Beets.—The presence of scab on the nples was so often noticed that it was thought best to make analyses of ooth and scabby beets to see if the sugar content and the purity were luenced by the presence of the disease. A large number of the beets nted on 4th May were harvested on 2nd November, and from each of the rieties samples containing ten smooth beets and ten scabby beets were awn. Especial care was taken to have the beets in each sample of a variety similar weight and form. The results appear in Table VII.

TABLE VII.

Variety.	Smooth Beets.			Scabby Beets.		
	Degrees Brix.	Sugar in juice.	Purity.	Degrees Brix.	Sugar in juice.	Puri
Kleinwanzleben	16·7	14·0	83·8	15·8	12·8	81
Knauer	16·0	13·6	85·0	15·7	12·7	80
Vilmorin	15·9	12·7	79·9	15·9	12·8	80
Desprez	16·6	13·6	83·9	16·3	13·2	80

It will be noticed that in three out of the four cases the purity and su contents were less in the scabby beets. The two varieties giving the great difference between smooth and scabby beets were the Kleinwanzleben a Knauer. Both these varieties were badly affected by scab, 50 and 63 cent. respectively. Hence, no difficulty was experienced in getting samp in which every beet had a considerable amount of its surface covered by sc The Vilmorin and Desprez varieties had only 31 and 27 per cent. scab resp tively, and the surfaces of the individual beets used were not so m covered with scab. In fact, while ten beets of these varieties could be secu which showed the presence of scab, it was not possible to obtain a sample either in which the beets were as badly affected as those of the Kleinwanzle or Knauer varieties.

It would seem that, aside from the difficulty of cleaning scabby be there is a decided disadvantage owing to loss of sugar.

Loosening Beets before Harvesting.—In 1891 Prof. H. H. Nicholson* tr the effect of loosening the beets with a horse beet-digger some time bef harvesting. His purpose was to break the connection between the beet a the ground, and prevent the second growth. At the time the experim was made the ground was wet from excessive rains. His results sho that the loosened beets seemed to retain their sugar, while the beets loosened took on a second growth, and the sugar content and purity seem to decrease.

In our experiment the beets were loosened on 13th November, and beets harvested on 15th November. The severe weather beginning on 15th put a stop to all work in the beet field, and so the experiment co not be continued. The experiment was not begun at an earlier date beca the beets were gaining in sugar. The results appear in Table VIII. first seven samples were from home-grown seed.

TABLE VIII.

Variety.	Beets Loosened.			Beets not Loosened.		
	Degrees Brix.	Sugar in juice.	Purity.	Degrees Brix.	Sugar in juice.	Pur
Bulteau's Desprez	16·5	13·2	80·0	16·2	13·7	84
F. Desprez	17·1	14·8	86·5	17·1	14·6	85
Kleinwanzleben	16·5	13·8	83·6	16·7	14·0	83
S. Le Grand Imported White ...	15·5	13·2	85·1	16·4	13·8	83
Vilmorin	15·6	13·0	83·3	14·1	11·2*	79
Imperial	16·9	13·9	82·2	15·6	12·5	80
Red Top	15·3	12·1	79·1	14·9	11·8	79
Kleinwanzleben	16·5	12·9	78·2	19·0	15·5	81
Knauer	17·0	13·5	79·4	16·9	13·8	81
Desprez	17·6	14·0	79·9	17·0	13·5	79
Vilmorin	17·0	13·5	79·4	17·7	14·1	79

* Beets very scabby.

* Nebraska Experiment Station, Bulletin No. 21, pp. 19-21.

e condition of the ground was quite different from that when Prof. olson made his experiment, as our ground was dry and hard.

rieties.—An examination of the tables will show results obtained on rent varieties. European growers sometimes recommend Vilmorin for y land, Knauer for sandy land, Kleinwanzleben for medium land. At tation farm the Kleinwanzleben seems to do the best, all things con- ed. But with a favourable season we can grow a good crop of either of our varieties.

ome-grown Seed.—The experiment with home-grown seed* was repeated eason, and the beets raised were as good as from foreign seed.

mples of seed grown in Nebraska were received from the U.S. Depart- of Agriculture, Chemical Division, too late for use. They will be ed in 1894.

st per acre of raising Beet.—The areas under cultivation in beets in state have been too small to permit of finding the cost per acre of ng beets for factory use. It may be of interest to give the results rted from sections where the industry is already established. These ts are for the year 1891, and are taken from Bulletin No. 21 of the aska Experiment Station. The numbers in the table were obtained both farmers and factories:—

TABLE IX.

State.			Cost per acre.	Yield per acre.
				tons.
ASKA	Experiment Station	Series 1	$32·75	31·50
		Series 2	29·14	15·58
	State at large		37·25	21·70
	Grand Island		....	13·60
	Average		33·06	22·59*
ORNIA	Watsonville		26 to 40	13·50
	Alvarado		35·00	15·00
	Average		35·00	14·2
—Lehi			39·46	12 to 15

*Long tons.

Utah 2·50 dollars per acre for irrigation is included in the cost, and r was paid 1·50 dollars per day. In all cases the beets were sold for llars per ton.

ture work.—The most necessary thing to be undertaken in the future tigation of this problem is the cultivation of 1-acre plats of beets by ers in different parts of the state in order that they may become familiar the work required to raise beets on a large scale and to get the yield cost per acre. I understand that arrangements were made last fall een parties interested in the development of the industry and 100 ers to raise 1 acre each, using seed and instructions that were to be ished. The Experiment Station will co-operate in this work by making

*See Bulletin No. 43, Indiana Experiment Station, p. 18.

analyses of all samples sent us, provided that samples are taken accor directions furnished by us, and are accompanied by a full report work.

The farmers stand in no danger of serious loss in making this expe as the beets are of high value as a feeding material for cattle (es milch cows), sheep, and hogs.

With the information derived from this work the farmer will better position to make contracts for raising beets for the factory sho industry be established in the State.

The results obtained in the State during the past five seasons, inclu they do three of the most unfavourable seasons on record, lead us conclusion that the sugar beet crop is a promising one to add to our crops, and ought to direct the attention of capital to this State, as a able position for investment in sugar beet factories.

Another Authority.

By way of affording additional information, recent American files an article from the pen of Dr. H. W. Wiley, head of the Divi Chemistry of the American Department of Agriculture, which appe the April issue of the *Engineering Magazine*, and which we also rep for the benefit of our readers in view of the value of the inform imparts :—

Beet Sugar Interest in the United States.

The production of beet sugar is now receiving so much attention State (California), that many readers will be profited by a general re the industry in this country and a descriptive narrative of the wa means employed. Dr. H. W. Wiley, who is at the head of the Divi Chemistry of the Department of Agriculture and has immediate ch the sugar experiments and investigations made by the Government, following admirable article, of the scope indicated above, in the Apr of the *Engineering Magazine* :—

The beet-sugar industry in the United States is in its infancy, ther only seven manufactories of this product in operation in this country oldest of these, at Alvarado, California, was erected about 15 years ag has been operated every year since. The factories next in order in se are those at Grand Island, Nebraska, and Watsonville, California younger than these, by one year, are the factories at Norfolk, Neb Lehigh, Utah; and Chino, California. The youngest and smallest factories, located at Staunton, Virginia, has been operated only one The increase in the rate of beet-sugar production in the United during the past few years is shown as follows :—

	Pounds.
In 1887	600,000
In 1888	4,000,000
In 1889	6,000,000
In 1890	8,000,000
In 1891	12,004,838
In 1892	27,083,288
In 1893	43,648,797

ie next table gives the production, during 1893, at the different
ries, as follows:—

	Pounds.
Staunton, Virginia	36,458
Grand Island, Nebraska	1,835,900
Lehigh, Utah	3,750,000
Norfolk, Nebraska	4,000,000
Alvarado, California	4,486,572
Watsonville, California	14,500,000
Chino, California	15,036,867

e amount of capital invested in the seven beet-sugar factories is about
),000 dollars. Tributary to these factories, under cultivation in beets,
bout 20,000 acres of land. The value of this land has greatly increased
it has been used for beet-growing, especially near Chino, California,
e the price per acre has become very high, as much as 200 dollars
ıg been paid in some cases. The cost of cultivating this land in beets
ısiderably more than 500,000 dollars a year. The production of beet
for sugar-making purposes in the United States during the past year
ɔximated 200,000 tons, and the average price paid to the farmers for
raw material was 4·50 dollars per ton.
will be seen that a large investment of capital in land and machinery
ı large outlay of money for labour are needed to produce a little over
00 tons of sugar per year. It is not difficult to foresee the large
ınt of capital that would be absorbed, the immense amount of labour
would be employed, and the great extent of land that would be placed
r cultivation, if even half of the sugar consumed in the United States
made from beets grown within the country. The yearly consumption
ıgar in the United States is now approximately 2,000,000 short tons,
the total production of all kinds of sugar—beet-root, cane, maple, and
ıum—is about 300,000 short tons, showing that a little less than one-
of the total amount consumed is produced at home.
e manufacture of beet sugar in this country is a matter for serious
deration. By reason of the restricted area suitable for the cultivation
ıgar cane, it is not to be expected that, under the most favourable con-
ıs, the production of cane sugar in Louisiana, Texas, and Florida will
largely exceed 1,000,000 tons. On the other hand, there are no limits
e possible amount of beet sugar which can be manufactured.

Beet farming is high-class work.

e production of sugar-beets is of itself an art. The ordinary forms of
ulture cannot be used for this purpose. Sugar-beet culture is, in every
, intensive, and not extensive, farming. High-priced lands can be used
ugar-beet culture on which it would be impossible to grow profitably
taple crops. Intensive culture, high fertilization, and scientific care in
respect characterise successful beet-sugar culture the world over. The
r-beet requires a deep, mellow soil, perfect tilth, entire freedom from
s and grass, and a great deal of hand-culture. The sugar-beet absorbs
quantities of water in its growth. It is fond of potash and phosphoric
and is not averse to nitrogen. It is a crop which should not be grown
than once in four years upon the same field, and this field, by judicious
ion and fertilization, is brought during this time into perfect condition
for the production of a maximum crop of beets. The establishment
eet-sugar culture in a community gives an object lessen in the highest
f agriculture. It acts reflectively upon every other branch of agricul-

ture, so that in countries which grow sugar-beets there are better wheat and maize, of barley and hay; there are better classes of liv finer horses and cattle, and in general the whole tone and character culture are elevated by reason of the influence, direct and reflexive culture of the beet sugar.

The sugar beet has been brought to its present state of efficienc application of scientific principles of culture in the production The mother beets selected for seed the previous year are chosen on of their perfect form and size. They are preserved during the w silos. In the early spring they are removed, and a diagonal core ta each one is analysed. The beets are in this way separated into grade showing above a certain percentage of sugar forming the *elite* or firs those falling within another class the second grade, with a third clas while all those which fall below the standard fixed for the lowest g rejected. Little has been done in this country in the way of the pr of beet-seed, but for three years the United States Department of ture has grown the highest-grade seeds at its station at Schuyler, N in accordance with the principles set forth above. The careful exp undertaken by the Department at this station at Schuyler have sho beets, quite equal to the best grown in Europe, are easily produce United States.

How the Beets are handled.

The sugar beets, which mature in September or October, are harvested, and the foliage, with a portion of the neck of the beets, by a knife. Each beet must be handled separately for this purp portion of the top of the beet is removed, because that portion co large percentage of the salts found in the beet. These salts—chiefly exert a very injurious effect upon the sugar juices during the pr manufacture. They are bitter; they unite with any oil which the b contain, and form soap, and they prevent large quantities of sug crystallising.

The sugar beet, having been brought to the factory prepared as passed through a long trough by means of a screw, through whic flows in the opposite direction from the movement of the beets. T are thus thoroughly cleaned, all fragments of soil and pebbles being therefrom. Thorough washing is highly important, since the pre sand, or soil, or grit of any kind upon the beets when they reach the machine rapidly dulls the knives, and produces bruised and in cuttings. The beets, having been washed, are elevated to a cutte diately over the diffusion battery. This cutter is a horizontal disk, several corrugated knives. These knives slice the beets, usually into V pieces, so that, when placed in a trunk, water may freely circulate them.

The beet cuttings, called "cosettes" or "schnitzel," are next cond the diffusion battery—a piece of apparatus designed for the extra sugar by means of the osmosis of the sugar-juices with the water brought into contact with the beet-cuttings. The diffusion-battery of from twelve to fourteen cells, so arranged that a liquor can be pa will from one to the other, and drawn off from any one of them at a The hot water which is used for the extraction passes from one another, becoming more and more charged with sugar-juices. Whe passed through a sufficient number of cells—usually ten to fourteen, ac to the size of the battery—it reaches finally the cell last filled w

ıttings, and from this it is drawn off into a measuring tank. When the ıttery is once filled its operation is continuous, one cell being filled with ıttings, and the exhausted cuttings being discharged from another, every me a portion of juice is drawn into the measuring tank. The exhausted ılp is passed through a press, by means of which a large portion of the ater is forced therefrom, and the residue makes a most excellent food for ıttle. This ration, however, is not a well-balanced one, and certain nitro-enous and fatty bodies are mixed with it in order to make a perfect food. il-cakes are very suitable for mixing with exhausted pulp for this purpose.

The sugar juices, withdrawn from the battery as above mentioned, are ıssed into large tanks, where they are saturated with lime, from 1 to 3 lb. which are used for each 100 lb. of juices. The temperature of the mixture then raised gradually, and meanwhile a stream of carbolic acid is blown rough the mixture. By this treatment the lime is precipitated as carbonate lime, carrying down with it a large portion of the impurities originally ntained in the beets. Beet juices, when first extracted, are usually of a ırk, almost inky colour. After treatment with lime and carbon dioxide in e manner above described, they are usually perfectly brilliant and of a ·autiful amber tint. After the lime is all precipitated the juices are passed rough filter-presses, on the cloths of which the lime and impurities are tained while the bright juices run through. A second treatment with lime ıd carbon dioxide is uniformly employed, and sometimes a third, in order secure sugar juices of high purity. The carbon dioxide used for this ırpose is derived from a lime-kiln in connection with the factory, which also rnishes the lime necessary for the precipitation of the impurities.

The purified juices, treated as above described, are next conducted to a ultiple-effect evaporating apparatus. Here the juices are concentrated to rup, the vapours from one of the multiple effects being used to boil the quor in the second, and the vapour from the second being used to boil the quor in the third. When this apparatus has two pans, it is called a double fect; when three, triple; they rarely contain more than four, while three usually the number found.

The syrups, treated as above, if only raw sugar is to be made, are carried rectly to the vacuum-strike pan. Small quantities of syrup are first taken to the pan and reduced to the crystallizing point. When fine crystals of gar appear, additional portions of the syrup are drawn into the pan, ntinuously, or from time to time, and the small miscroscopic crystals first rmed begin to grow to the required size. The operation usually requires om three to sixteen hours, according as the pan is a quick or slow-boiling e.

The sugar thus crystallized during the process of boiling is removed from e pan into a mixing apparatus, where it is thoroughly mixed by means of volving arms. It passes then directly into the centrifugal apparatus, which, ving perforated sides and revolving with great rapidity, quickly removes e molasses from the crystals, leaving the latter in a very dry form and itable for transmission to the refinery.

In some beet-sugar factories the refining is done during the process of ınufacture. In this case the syrups, before concentration, are filtered rough bone-black or saturated with sulphurous acid. By these methods a ıre white crystal of sugar is obtained, which on being dried in a granulating paratus after coming from the centrifugal, forms granulated sugar.

The molasses which is obtained by the above process is re-boiled, and a cond crop of crystals obtained therefrom. The molasses from this second op of crystals is re-boiled, placed in tanks, and left to stand for five, six,

or even eight months, at the end of which time another crop of
dark and mushy, has been formed, which can be separated by the
fugals in the usual way. The final molasses, which contains a cons
quantity of sugar, is used either for distilling purposes, for fertilis
poses (on account of the large amount of potash which it contain
may be subjected to treatment with freshly-burnt and ground lime,
temperature, in which way the sugar which it contains is precipi
sucrate of lime, from which the other impurities can be separate
sucrate of lime can afterward be beaten up with water into a paste
lime precipitated with carbon dioxide as above described for purif
juices. In this way almost all the sugar which was present in the
can be recovered.

The manufacture of sugar is a continuous process, *i.e.*, the opera
on day and night. It is probably twenty-four or forty-eight hours
time the beets enter the factory before the crystals of sugar secure
from appear, and the process is of such a nature that it cannot be
except, usually, at the end of a week or two weeks, when the house
down for repairs or renovation. An ordinary beet-sugar factory
capacity for the consumption of about 250 tons of beets per day, an
make from 200 to 240 lb. of sugar per ton. In Europe, larger fact
very common, capable of working from 400 to 600 tons of beets per
central factories there is a large number of diffusion batteries sit
different points, in which the juices are extracted. From these
places the juices are delivered to the central factory by means of pi
usually laid under ground. A central factory of this kind will b
able to take care of the juices from 1,000 tons of beets per day.

Everyone who desires to see the prosperity of American ma
American ingenuity, and American agriculture, should favour the
ment of the beet-sugar industry. There is no other way in wh
plethora of agricultural products can be so readily relieved and
prosperity brought to our agricultural interests, thus stimulating eve
interest in the land. The total consumption of sugar in the civilise
is not far from 7,000,000 tons, of which the United States uses two-s
Of the 7,000,000 tons, over 4,000,000 are made from sugar-beets
thus seen that in the race for the markets of the world the sugar
already ahead of its most dangerous rival, the tropical sugar-cane.
is room, however, for both these sugar-producing plants, and there i
to believe that, with favourable conditions, a great indigenous sugar i
including cane and beet sugar, can be established in the United Stat

a Species of Moth (*Epicrocis terebrans*) Destructive to Red Cedar and other Timber Trees in New South Wales.*

By A. SIDNEY OLLIFF,
Government Entomologist.

r in March, 1889, the young red cedar trees (*Cedrela toona*, Roxb.) State Forest Nursery, at Gosford were found to be suffering from the of some insect, which seriously interfered with their growth, and as il appeared to be upon the increase, the matter was brought before otice of the Colonial Secretary's Office, to which Department the t Nursery was at that time attached, with a view to obtaining accurate nation as to the nature of the pest, and the best means of checking vages. For this purpose the Principal Under Secretary, Mr. Critchett er, communicated with Dr. E. P. Ramsay, the Curator of the Australian um, forwarding specimens of a moth, and portions of the trees con-g a number of larvæ or caterpillars, presumed to be the early stage of companying moths, and the real cause of the injuries. Unfortunately specimens could not be identified owing to their poor condition, but amsay recommended that the trees should be carefully examined, and e infected parts cut off and burnt, and subsequently he handed the to me for investigation, with the request that I should endeavour to the moth. This I failed to do, although I had more than one con-ent of larvæ from the nursery, owing to the dry condition in which edar twigs were received, so it was determined that I should visit rd, and if possible obtain a better supply of material. Accordingly nd August I made a careful examination of the plantations, and with ssistance of the late Mr. J. McCoig, the overseer of the nursery, eded in obtaining a number of larvæ in various stages of growth. I l that the injury is caused by the larvæ burrowing into the main stems eaders" of the trees for the purpose of eating the pith and soft tissues, has the effect of arresting the natural growth of the tree, and thus isly affecting its value for forestry purposes. At the time of my visit sford a large number of the infected trees had been freed from the y the energy of the overseer, who had used the pruning-knife with ent results, but a few of the larvæ were still to be found by careful hing in an outlying plantation at some distance from tho nursery. A er of the "leaders" containing the burrows of these larvæ were cut fterwards placed in a jar partly filled with earth and sand, which was

* several correspondents have lately made inquiry as to the habits of this moth, and blication in which it was described is not readily accessible, it is thought that a t may be useful. The original paper is here reproduced with a few unimportant cations.

kept moist to prevent the wood from shrinking. By this means a numb of the moths were reared during October, and they proved to belong to t Phycitidæ, a family of Lepidoptera containing a large number of speci which in their larval state are internal feeders, and nearly related to cert species included in Zeller's genus *Epicrocis*. In general form, and in its habi the Gosford moth also greatly resembles a species (*Magiria robusta*, Mre from Ceylon, observed by Dr. Thwaites feeding within "branchlets mahogany," but as it appears to differ in certain points from this spec and from *Epicrocis patulalis*, Wlk, the form which it most nearly approach I have ventured to characterise it under the name *Epicrocis terebrans*.

EPICROCIS, *Zell.*†

The species here characterised as *Epicrocis terebrans* is in my opin congeneric with *E. sublignalis*, Wlk. (*E. strigiferella*, Meyr.), and *mesembrina*, Meyr., as it agrees in every particular with specimens of th species kindly identified by Mr. E. Meyrick.

Fam. PHYCITIDÆ.

EPICROCIS TEREBRANS, *Oll.*

I.

Records Aus. Mus., p. 32, pl. II (1890).

♂ ♀. Head dull reddish-ochreous; thorax and abdomen grey ochreous, the former paler in front. Labial palpi whitish, inclining fuscous externally, not reaching above upper margin of eye. Anter brownish-ochreous, very finely ciliated, basal joint large, thickly clot with scales. Forewing elongate, moderately broad, dilated, greyish-ochre suffused on disc and on inner margin with brownish-fuscous, thickly clot with white scales near anterior margin and towards apex from basal t thirds, and dusted with fuscous and dull carmine scales; an indistinct d longitudinal fuscous line near costa, extending from base to just before a an irregular fuscous patch at extremity of cell bordered externally white; a second very indistinct fuscous line on disc extending to midd vein 1 dull fuscous, veins 2–6 at apical fourth streaked with black, the stre short, reaching the margin, interrupted in their middle; two inconspicu dark fuscous spots on costa before apex, and another similar but sma spot on inner margin before anal angle; cilia dull carmine, ochreous at b with a distinct fuscous parting line, interrupted by a row of ochre whitish points. Hindwing whitish, suffused with fuscous towards apex at costa; hind-margin narrowly edged with fuscous; cilia whitish, inclin to fuscous near anal angle, a dark fuscous parting line near base. Exp ♂ 28–33 mm.; ♀ 34–36 mm.

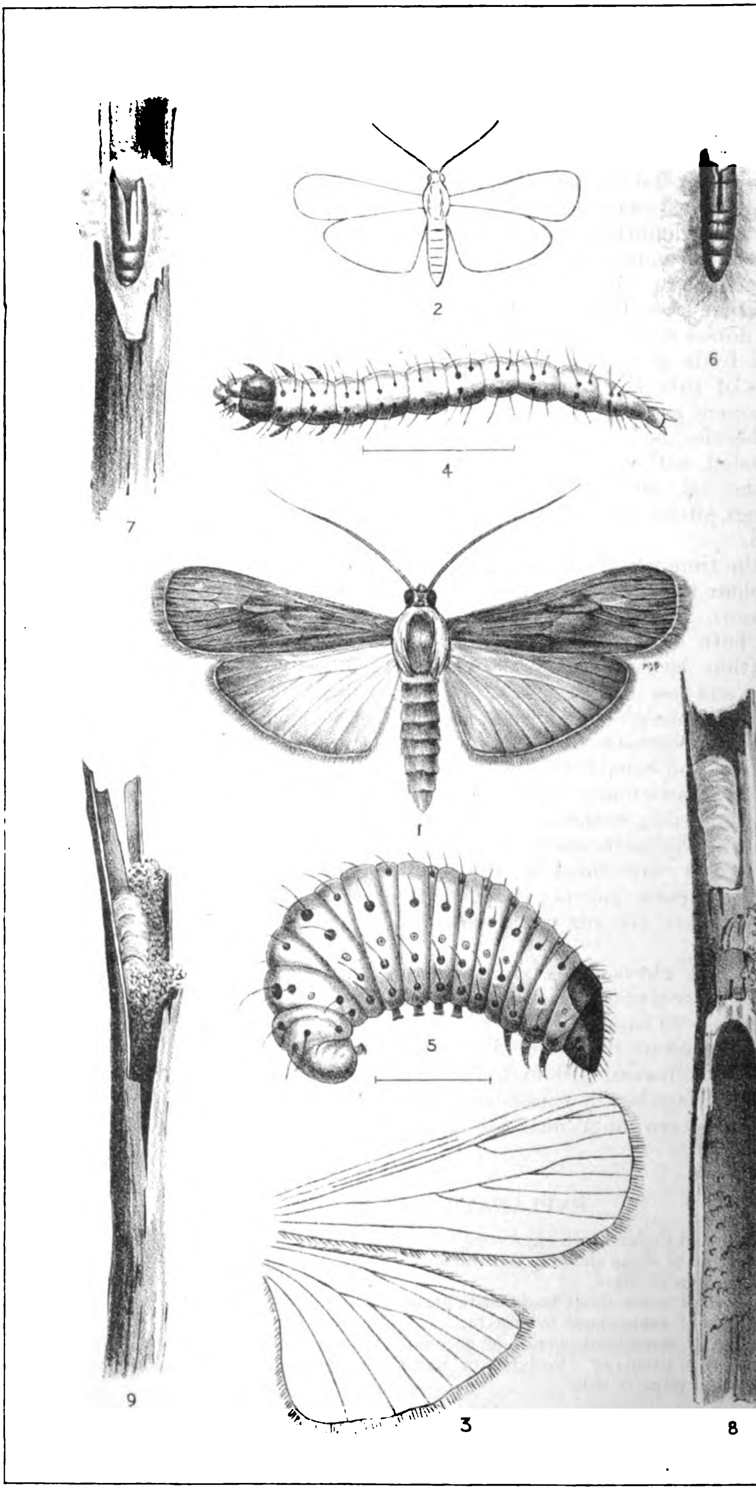
Gosford, Hawkesbury River, New South Wales; larvæ feeding in t of *Cedrela* and *Casuarina*.

♂ Antennæ feebly dentate; ♀ simple; in form similar to thos *Epicrocis sublignalis*, Wlk.

This species appears to be nearly allied to *Epicrocis patulalis*, Wlk. *rufitinctella*, Meyr.), but the markings are even less definite than in form, judging from the detailed description published by Mr. Mey (Proc. Linn. Soc. N.S. Wales, iii., p. 203, 1879). It may be recognised the presence of the dark patch at the end of the discoidal cell, relieved

* Moore, Lepidoptera of Ceylon, iii., p. 365, pl. 184, fig. 4 ♂, 4a larva (1887).

† Proc. Linn. Soc. N.S. Wales, vii., p. 157 (1883), and Trans. Ent. Soc. Lond., p. 257.



Epicrocis terebrans, Olliff.

(Red Cedar Moth.)

ly by a patch of white scales, by the characteristic streaking at the
l extremity of the wings, and by its generally larger size.
ne adult larva elongate, rather robust, with sixteen legs and nine pairs
teral stigmata, of which the first pair is pro-thoracic. Head and
l surface of 1st thoracic segment black; 2nd and 3rd thoracic segment
body pale sea-green, inclining to purplish in certain lights, especially at
ides, an ill-defined salmon-coloured streak on each side in the region of
tigmata, extending from the 4th to 11th segment inclusive, this marking
conspicuous on thoracic segments; with two dorsal and three lateral
of rather large black tubercles, each giving rise to a long outstanding
the dorsal rows are somewhat irregular owing to the presence on the
ental folds of similar tubercles which are a little nearer the sides; of
rows of tubercles, that just above the legs is the least conspicuous;
st thoracic segment is sea-green at the sides, and is provided with two
l tubercles, being a continuation of the lower lateral rows; 12th seg-
rounded, without tubercles; stigmata or spiracles ochreous, placed
th the 1st, and above the 2nd and 3rd rows of lateral tubercles;
cic legs pitchy, abdominal legs sea-green, inclining to fuscous. Length
) mm.
to the time when the larva is about two-thirds grown it is of a more
re colour than the above description would imply, being of an obscure
sh-brown tinged with green, and having the head dark brown, the
cles, both dorsal and lateral, brownish-black, and the last abdominal
ent (that bearing the anal claspers) ochreous. In form it is more
uated and less robust.
observations go to show that throughout the life of the animal its
ncy is to increase in width, the adult larva being proportionately of
er girth, and capable of less extension than the young. In its fully
n state, particularly when about to change to the pupa, it bears a
ng resemblance to the larvæ of certain Saw-flies or Tenthredinidæ, many
hich, like the larva under consideration, are internal feeders, but this
ess is only superficial, as the number of the feet, and the position of
piracles, clearly indicate its lepidopterous nature; and I may add, its
al structure accords with what we know of the larvæ of the family
itidæ.
e pupa or chrysalis is reddish-brown, and is enclosed in an elongated
n cocoon, composed of coarse grey silk. Usually the cocoon is placed
e entrance to the burrow in which the larva has lived, but sometimes it
nd attached to the stem of the food-plant. In no case did I observe
upon the leaves, although in a few instances I saw three or four
ns spun together in a mass and attached to a twig; in every instance,
ver, they were found near the burrows from which the larvæ had made
escape.

EXPLANATION OF PLATE.

. 1. The Red Cedar Moth (*Epicrocis terebrans*, Olliff ♂).
2. Outline of same showing natural size.
3. Venation of same.
4. Larva of same about two-thirds grown.
5. Larva of same about to pupate.
6. Pupa of same, and portion of cocoon.
7, 8, and 9, Stems or "leaders" of Red Cedar showing borings of larvæ, cocoon, and pupa *in situ*.

th the exception of Fig. 1 by Mr. H. S. Burton, the plate is reproduced from
ings by Mr. G. H. Barrow.

Wool-growing in New South Wale

QUESTIONS submitted by Mr. Alex. Bruce (Chief Inspector of New South Wales, and accredited by the Government of that make inquiries in Great Britain), and answers thereto by Mr. Chas. wool merchant, Bradford, and Chairman of the Wool Supply Com the Bradford Chamber of Commerce.

1. What is the reason of the disproportionately low prices of th superfine merino wools? Are they attributable to anything else general depression in trade and the failure of the American dem are these low prices for the fine wools likely to continue?

Answer.—To fine wools being considerably out of fashion and the of the American demand. Great improvements in machinery have a to make goods of 60s. and 64s. qualities so perfect that the very fine have not the proportionately high value that they once had. (*Se* No. 6 for definition of "60s. and 64s.")

2. Are the comparatively high prices of cross-bred wools likely to in the face of the fact that crossing is becoming more and more co both North and South America, as well as in Australasia?

Answer.—If crossing increases in an abnormal degree, cross-br will certainly suffer in proportion, especially when out of fashi tendency of fashion is from one extreme to another, hence goods m merino wools will probably come into fashion again.

3. As regards a first cross with merino, which breed of the Engli gives the highest priced wool per lb., the Lincoln, the Border Leic English Leicester, the Shropshire, the South Down, or the Romney

Answer.—That which produces the finest cross-bred wool, always it is not unduly wasty in grease. As a general rule, all else bei the lowest qualities of cross-breds waste least in scouring, whilst t lose the most.

4. Is the wool of the first cross of the Merino with (say) the Li that of the second (the Lincoln put again to the cross-bred ewe) o the third or fourth cross the most value per lb., and for which cr demand the greatest and most likely to continue?

Answer.—This is again dependent on fashion, which is ever chang

5. I would explain with respect to this question that in judgin sheep at our metropolitan shows we divide them into three cl (1) "Fine" (including superfine), (2) "Medium," and (3) "Stron

the view of simplifying the work of the judges and giving each description of sheep a chance. This division again agrees in a general way with the selection of sheep for our different classes of country. Thus, on the comparatively lightly grassed land we keep the smaller-framed "fine" merino, on the more thickly grassed we have the "Medium" (the middle-sized sheep), and on our best and most nutritious grass we keep the "Strong" large-framed Merino. Keeping in mind this explanation, and supposing that a breeder held country which could carry either a "Medium" or "Fine" wooled sheep, which would you recommend him to keep with the view to his growing the wool most likely to be in demand and make the better return for the sheep? Supposing again that a breeder held land fit to carry either a "Medium" or a "Strong" Merino, which of the two do you think would as regards wool be likely to pay him best?

Answer.—Unless the sheep were a very good lot of fine or superfine wooled ones, probably those which produced the heaviest fleeces would pay best, in the medium and the fine, and also in the strong and medium. At the present time the prices of strong, medium, and fine are so near that the above in their present proportion of value would probably be correct.

6. Has Merino wool ever been classified, and the classification recognized by the trade as "Strong," "Medium," and "Fine" and "Superfine," by the diameter of the fibre? I have seen such a classification as the following:— "Strong," $\frac{1}{900}$ to $\frac{1}{1000}$ of an inch; "Medium," $\frac{1}{1100}$ to $\frac{1}{1400}$; and "Fine" and "Superfine," over $\frac{1}{1400}$ of an inch. Please say if you consider these figures are correct.

Answer.—Probably; but buyers and users of Merino wools classify them by terms which indicate the qualities or counts of yarn which it is possible to spin them to, *e.g.*, "Strong" is called 60s., "Medium" ranges from 64s. to 70s., "Fine" and "Superfine" from 80s. to 120s. Your figures have no recognition in England.

7. How far are the maximum number of marks for the several points in the accompanying Award Paper, framed for judging a "Medium" combing Merino fleece, correct, looking at the matter from a breeder's point of view; *i.e.*, is the paper framed so as to give to each of the points the number of marks which it ought to receive according to the relative value of such point to the breeder and manufacturer? While the breeder naturally sets a high money value on the weight-making points, such as length of staple, density and evenness, and fulness of covering all over, as they affect the return per sheep, these points with the exception of length of staple, and, perhaps, to a small extent, density, are of comparatively little interest to the wool buyer and manufacturer, as they purchase by the bale; but although this may be considered to a large extent a breeder's matter, I should be glad to have your opinion how far the division of the scale into forty-two for weight-making points, and fifty-eight for quality of the wool, is a correct division. Supposing that the division is right, the correct apportionment of the fifty-eight marks set out in the paper under the head of quality of fleece, according to their respective money values, is a matter entirely for the wool merchant or manufacturer, and I will feel greatly obliged by your revising, and where necessary altering the marks under that head (whether you alter the divisions made by me of forty-two and fifty-eight or not) according to the relative money values which you, as a wool merchant, would place upon them.

Best Fleece in grease of Medium Combing Merino Ram, over 18 and under 30 months.

Section , Class .

					Weight of fleece.			Quality of fleece.						
No. of Exhibit.	Actual age of Sheep.	No. of days of growth of fleece.	Live weight of Sheep.	Gross weight of fleece.	Length of staple.	Density of fleece.	Evenness and fulness of covering.	Brightness.	Softness.	Fineness and character of wool.	Strength and elasticity of staple.	Evenness and quality all over fleece.	Total.	Awar
	mths.		lb.	lb.	10	14	18	6	8	16	10	18	100	
Examples. 7	24	370	120	13	8	11	17	4	7	13	9	15	84	2n pri
8	19	359	110	10	8	10	13	5	6	15	7	13	77	
9	29	360	122	14	9	12	17	5	7	14	8	16	88	1s pri

If I have omitted any points to which marks should have been allotte you will, of course, add them to those submitted by me; and having done s you will, of course, deduct the necessary number of marks from those no set out in the Award Paper, and allot the fresh points their proper numb of marks. As it is taken for granted that the exhibits are free from bur and grass seeds, no points are set in these Award Papers for freedom fro them.

Answer.—Appended is the number of marks which a buyer would probab consider, and in proportion as he would value the wool. He wants leng (and it should be as regular as possible), strength of staple, fineness, a evenness of quality. This list would divide the marks as follows:—Weig 32; quality, 68. With the present disproportion of prices between t different qualities, the buyer's first question in looking at Merino wool is- "What will it waste?" His next, "What is its quality? and do I wa this particular grade?" Then he examines the length and the soundness, & Sound wool produces more yarn than tender wool, and costs less to work.

Weight of fleece	Length of staple	20
	Density of fleece	6
	Evenness and fulness of fleece ...	6
Quality of fleece	Brightness	6
	Softness...	8
	Fineness and character	20
	Strength and elasticity of staple ..	20
	Evenness of quality all over fleece...	14
		100

CHARLES FAWCETT,

Chairman, Wool Supply Committee,
Bradford Chamber of Commerce.

11th April, 1894.

the Choice and Use of Artificial Manures.

(*continued.*)

By F. B. GUTHRIE,
Departmental Chemist.

ne remaining sources of phosphoric acid, *mineral phosphates*, or lites, are little used in the raw state as a manure, but as they form the basis bulk of the superphosphates and mixed manures on the market, a short nt of them will not be out of place here.

mineral known as apatite is a crystalline, phosphorite a non-crystal- orm of phosphate of lime. These occur as rock-masses, or in nodules ded in rocks of sedimentary origin in many parts of the world, notably la, South Carolina, Florida, England, Spain, and Norway. The lian phosphate is a crystalline rock, the English coprolites are for the spherical nodules found in the green sand and chalk.

ound phosphate is the name usually given to the above compound when ground. They are not much used in this condition, but if so employed, ssential that they should be as finely ground as possible. They are itrogenous.

anos are the dried dung of fish-eating sea-birds, and are obtained prin y from the rocky islands in the Pacific and Atlantic Oceans. They are nitrogenous or contain no nitrogen, the amount of this ingredient asing with the age of the deposit. Guano was at one time very exten- used as a manure, but it is being largely superseded by cheaper and concentrated forms of phosphoric acid and nitrogen. Nevertheless, it d not be entirely overlooked, in view of the quantity of it existing in lands of the Pacific Ocean off our own coasts.

nitrogen exists often in the three forms of organic nitrogen, ammonium and nitrates, the last form being the most soluble form in which gen can be applied to the soil. They are excellent manures for cereals, ially as a top-dressing in the spring.

ey likewise contain an appreciable percentage, 2 to 3 per cent., of potash. bulk, however, of the mineral phosphates and of phosphatic guanos nverted by treatment with sulphuric acid into superphosphates.

perphosphates.—When bones, bone-ash, or any of the substances men- l in the previous paragraphs, are acted upon by oil of vitirol, or sulphuric the phosphate of lime which they contain, and which exists in the form calcium phosphate, is converted into a different lime compound, known ono-calcium phosphate, or superphosphate. This substance differs from the original phosphate in being readily soluble in water. We lready seen that the availability of a manure as plant-food depends y upon its ready solubility, consequently a phosphate of lime soluble in is the most available form of this substance. Plants, however, are not dent for their food-supply upon such compounds as are soluble in water, e able, by means of the acid juices secreted in the roots and root-hairs,

to avail themselves of a class of compounds soluble in vegetable-acids. It is, indeed, very improbable whether superphosphate remains in the soil for any length of time in that condition, for it is readily decomposed, both by carbonate of lime and by the iron and alumina salts present in the soil. Carbonate of lime converts it into a third compound of lime and phosphoric acid known as bi-calcium phosphate. This substance is insoluble in water, but being in a very finely divided state is readily dissolved by the plant-acids. Iron and alumina attack the superphosphate even more rapidly, converting it into phosphates of iron and alumina, to which the same remarks apply.

This point is of further importance in reference to the composition of the superphosphates sold as manures, for they also contain a considerable quantity of the bi-phosphate in question as a rule.

A glance at the table of manures in another part of this number will show this. The action of the vegetable acids above mentioned may be fairly typified by that of citric acid or ammonium citrate, and the phosphoric acid represented in the tables as "citrate soluble" is just this bi-calcium phosphate, which is formed to a greater or less extent in such manures by the inter-action of superphosphate and unchanged tri-calcium phosphate. In a superphosphate, therefore, as usually purchased, there will be not only the water-soluble superphosphate, but also a certain quantity of the reverted phosphate, which is insoluble in water, but is, nevertheless, available for plant-food, and is of only slightly lower fertilising value than the water-soluble phosphate.

Superphosphate is essentially the manure for root-crops, and in all cases where a rapid return is wanted. For autumn manuring and for the manuring of permanent pasture, bone-dust is equally effective, and the conditions under which it will be advisable to use the one or the other form of phosphate will vary under different circumstances.

Superphosphates are more especially beneficial on soils of medium nature and such as contain lime. Indeed, in sandy soils poor in lime it has been found to be of very little benefit. It must not be forgotten that it is an acid manure, and, in the absence of lime to neutralise it, may even prove injurious.

It is applied usually at the rate of 3 to 4 cwt. per acre, the amount varying with the nature of the soil and with the quantities of the other manures used in conjunction with it. It is of especial value in the case of turnips and root-crops, and it forms the basis of the "general" manures, special manures, mixed fertilisers, &c., such manures being usually prepared from superphosphate by the addition of sulphate of ammonia or nitrate of soda and potash salts.

Superphosphate obtained from mineral phosphate contains no nitrogen. That obtained from bones usually contains 2 or 3 per cent., a portion of the nitrogen having been lost in the process.

The following table will serve to convey an idea of the result of the action of sulphuric acid upon mineral phosphates and upon bone-meal respectively :—

	Superphosphate from Mineral Phosphate.	Superphosphate from Bone-meal.
Water	16·00	10·00
Volatile and combustible matter	9·50	33·00
Phosphate of lime (soluble in water)	28·00	31·50
Insoluble phosphate of lime	6·00	2·00
Sand and insoluble matter	5·00	3·00
Containing nitrogen	......	3·00
Equal to ammonia	......	3·60

The tendency to revert is greater in those superphosphates which contain ron and alumina, and in such manures a portion of the soluble phosphoric ıcid often reverts to the citrate-soluble condition on keeping for a length of ime.

"Dissolved bones" is the name applied to superphosphate prepared from ›ones.

"Dissolved guano" is superphosphate obtained from guano.

"Fish guano" is not a guano, but fish offal.

"Dissolved bone compound" is a term applied to a mixed manure, preared usually from mineral superphosphates, with the addition of bones, lood, &c.

Thomas Phosphate, or *Basic slag* must also be mentioned amongst phoshatic fertilisers. It is a waste product in the manufacture of steel by the 'homas Gilchrist, or Basic process, and contains in the form of a phosphate f lime the phosphorus existing in the original impure pig-iron. In Germany normous quantities of it are consumed, and in England its use is largely ıcreasing. In these countries it can be obtained at very small cost, and as proved itself a very valuable and cheap form of phosphoric acid, its rice in England being about £2 per ton, but its great weight and the onsequent cost of transport has, no doubt, hitherto prevented its economical se in this country.

"*Patent phosphate meal*" is a name given to a basic slag which is prouced by a slight modification in the Thomas Gilchrist process, and is very ich in phosphoric acid.

Analyses of Commercial Fertilisers.

BY F. B. GUTHRIE.

THE accompanying list of manures obtainable in Sydney, together with thei composition as determined by analysis, and their price, is the result c revision of similar lists that have appeared in the *Gazette*, new manure having been added and several of the old ones having dropped out.

The list is compiled in the interest of the farmers; it is hoped that may serve as a guide to those requiring a particular class of manure. It i not pretended that all manures on the market are here represented, but a those here given have been analysed by the Department, and the figure given are those obtained from samples submitted to the Department, wit the exception of the Sugar Company's manures. The list will be mad more complete in course of time. The column of values requires som explanation. These figures are calculated from the composition of th manure as represented by analysis, a definite unit value being assigned t each of the fertilising ingredients. It will be found that these figures ar considerably lower than those hitherto adopted, and they must be substitute for the latter. The values of these fertilising ingredients are controlled b the market, and are subject to frequent change; consequently they requi revision from time to time.

The units on which the values here given are computed are the fo lowing:—

UNIT VALUES of fertilising ingredients in different manures.

Nitrogen in ammonium salts and nitrates ...	...	13s.	per uni
Nitrogen in blood, bones, offal, &c.—fine...	...	11s. 4d.	"
" " " medium	...	11s. 2d.	"
" " " coarse	...	11s.	"
Phosphoric acid in bones, offal, &c.—fine	...	2s. 6d.	"
" " " medium	...	2s. 4d.	"
" " " coarse	...	2s. 2d.	"
Phosphoric acid in superphosphate—			
" water-soluble ...	...	5s. 4d.	"
" citrate-soluble	...	4s.	"
" insoluble	...	2s. 6d.	"
Potash	...	6s.	"

"Fine" is that portion of the bone-dust which passes through a sieve c 50 meshes to the inch.

"Medium" that which passes through a sieve of 12 meshes to the inch.

"Coarse," that portion which does not pass through a sieve of 6 meshes t the inch.

To determine the value of any manure the percentage of each ingredient is multiplied by the unit value assigned above to that ingredient, the result being the value per ton of that substance in the manure. For example, a bone-dust contains 4 per cent. nitrogen and 20 per cent. phosphoric acid :—

4 × 11s. 4d.=£2 5s. 4d.=value of the nitrogen per ton.

20 × 2s. 6d.=£2 10s. 0d.=value of the phosphoric acid per ton.

£4 15s. 4d.=value of manure per ton.

It must be clearly understood that the value thus assigned, depending olely upon the chemical composition of the manure, does not represent in all ases the actual money value of the manure, which depends upon a variety f causes other than the composition, and is affected by local conditions.

It is simply intended as a standard by which different products may be ompared. At the same time it has been attempted to make the standard ndicate as nearly as possible the fair retail price of the manure, and the fact hat in the majority of cases the price asked and the value assigned are fairly lose shows that the valuation is a fair one.

To economise space only those ingredients are given whose presence irectly affects the value of the manures. Full analyses can be obtained if esired.

In the table of mixed fertilisers, &c., it will be noticed that three columns re assigned to phosphoric acid, and a different unit-value assigned to each, ater-soluble, citrate-soluble, and insoluble. When bones or mineral phoshates are acted on by sulphuric acid, a portion of the bone-phosphate is onverted into another lime-compound known as mono-calcic phosphate or perphosphate. This compound is soluble in water, and it is to its presence at the rapid action of the superphosphate is due.

This is the "water-soluble" acid of the table.

In many superphosphates, however, a considerable portion of this comound has undergone change. This change may be due to the quantity of lphuric acid used in the manufacture, to the quantity of salts of iron and umina present or to the length of time it has been kept, and it results in the rmation of a third lime compound—bi-calcic phosphate. This is known as reverted" or "retrograde" phosphoric acid, and, being insoluble in water it soluble in ammonium citrate, is here given under the heading "citrate luble." A value has been assigned to the phosphoric acid in this condition termediate between the others. Its manurial activity has been found to e very little less than that of the water-soluble acid.

As many manure manufacturers prefer to use the term "reverted," it is ell to keep in mind that in this list the term is identical with "citrateluble." The only exception is in the case of Thomas phosphate. In this roduct the "citrate-soluble" is a compound of lime distinct from the hers; it is neither bone-phosphate nor superphosphate, nor reverted phosate, but is a fourth lime-compound, known as tetra-calcic phosphate. It soluble in ammonium citrate, and has practically the same manurial tivity as reverted phosphate. All bonedusts are graded, and it will be seen at a slightly different value has been assigned to the nitrogen and phoshoric acid in the various grades. It is to be hoped that the slightly creased value assigned to the finer product will induce manufacturers to y more attention to the production of a finer bonedust.

In the third table are a number of waste products which may in many ases be economically utilised.

List of Manures obtainable in New South Wales.

Bone and Blood Manures.

Manure.	Where obtainable.	Water.	Nitrogen.	Ammonia.	Insoluble.	Phosphoric Acid.	Value.	Price asked.	Remarks
							£ s. d.	£ s. d.	
Bone-dust ..	Sydney Soap and Candle Company, 337, Kent-street.	7·72	4·06	4·93	1·12	22·72	5 0 0	4 10 0	
"	D. Davis, Bulli	5·83	3·55	4·32	2·85	23·13	4 13 9	4 18 0	
"	W. Mills, Goulburn	6·83	1·57	1·91	29·69	12·34	2 7 6	4 10 0	On trucks.
"	J. Williams, Bone Mills, Lithgow	10·00	3·40	4·13	3·32	24·05	4 16 9	4 0 0	On trucks at Eskbank.
"	T. Halloran, Lake Albert Boiling-down Works, Wagga Wagga.	6·59	2·82	3·42	6·75	18·54	3 13 6	3 5 0	Bags weighed in.
"	Australian Meat Company, Ramornie, South Grafton.	4·51	2·49	3·02	6·09	22·73	4 3 6	3 0 0	Wholesale price in bags at wharf, Sydney.
"	J. Windross, East Maitland Steam Saw and Bone Works.	8·13	5·74	6·97	1·08	17·36	5 6 6	......	
"	Wolstenholme, West Maitland	8·90	3·26	3·94	3·89	22·79	4 10 9	......	
"	Bourke Meat Preserving Company, Bartley Hodgett.	6·39	6·80	8·26	0·98	10·29	5 0 0	4 5 0	
"	Bartley Hodgett and Company	......	5·46	6·63	10·98	11·15	4 8 0	3 15 0	
"	Boiling-down Works, Albury	7·85	5·23	6·36	2·42	12·11	4 5 0	......	
"	Botany Meat Works, Elliott & Co., 700, Harris-street.	8·63	3·71	4·59	2·70	21·84	4 17 0	4 15 0	
"	" " "	7·15	3·43	4·16	6·62	17·00	4 1 6	4 15 0	
"	Riverstone Meat Company, Hay-street, Darling Harbour.	5·54	2·42	2·94	0·45	23·37	4 3 6	4 10 0	On trucks at Riverstone.
"	T. Green and Sons, Mitchell Road, Alexandria.	6·28	2·91	3·53	0·25	26·97	4 18 0	70s. to 80s. according to qu'ntity	
Bone-dust and meat	" " "	7·92	4·03	4·89	0·89	17·96	4 13 0		
Gee's Fertiliser, B.B.	Sydney Meat Preserving Company, Rookwood and Auburn.	10·16	5·30	6·44	0·79	12·66	4 10 0	4 10 0	Special quotation for more than 1 ton.
Gee's Complete Fertiliser, P.B.B.	" " "	9·5	4·77	5·79	0·71	11·39	......	......	Sample contained 5 per cent. potash. Price same as B.B., 5s. per unit added for each unit potash.
Digestor refuse	Chilled Meat and Produce Storage, Young.	8·68	3·28	3·98	2·31	23·77	4 17 0	......	
Boiling-down refuse	Boiling-down Works, Albury	23·29	2·32	2·80	6·98	17·66	3 10 3	......	
Blood manure	Riverina Meat-chilling Company, Narrandera.	11·49	10·87	13·20	4·57	0·37	6 3 0	......	
"	Bourke Boiling-down Works, Bartley Hodgett.	10·63	12·37	15·03	2·44	0·83	7 0 0	5 10 0	
Dried blood	Riverstone Meat Company, Hay-	11·30	10·08	12·24	4·31	0·62	6 0 0	5 0 0	On trucks at Riverstone.

Manure.	Where obtainable.	Water.	Nitrogen.	Ammonia.	Insoluble.	Phosphoric acid.	Potash.	Value.	Price asked.
								£ s. d.	£ s. d.
Guano from Rocky Islet	Burns, Philp, & Co.	6·87	·75	·01	9·89	30·44	......	4 4 6	5 0
Fish manure	Austral Oil and Manure Co., Crown Road, Pyrmont.	10·88	6·00	7·40	5·39	8·23	......	4 9 9	4 0 0
Soot	Practical Chimney-sweepers' Association, Grove-street, Petersham.	......	3·08	3·74	26·32	......	......	1 15 0	2 0 0
Sulphate of ammonia	Australian Gaslight Co.	......	20·44	24·82	......	......	......	13 5 0	13 0 0
Kainit	Jules Renard & Co., 306, Kent-street	......	......	......	......	......	12·95	3 17 6	4 5 0
Sulphate of potash	Jules Renard & Co., 306, Kent-street	......	......	......	......	......	52·87	15 14 0	13 0 0
Chloride of potassium	Jules Renard & Co., 306, Kent-street	......	......	......	......	......	31·11	10 10 6	10 10 0

Superphosphates, Mixed Fertilisers, and Imported Fertilisers.

Manure.	Where obtainable.	Water.	Nitrogen.	Ammonia.	Insoluble.	Water-soluble Phosphoric Acid.	Citrate-soluble Phosphoric Acid.	Insoluble Phosphoric Acid.	Potash.	Value.	Price asked.
										£ s. d.	£ s. d.
No. 1.—Superphosphate manure	Colonial Sugar-Refining Co., O'Connell-street.	10	....	....	12	16	2	....	....	4 15 0	4 10 0
No 2.—Turnip and general manure	Colonial Sugar-Refining Co., O'Connell-street.	10	1·6	2	11	15	2	....	1	5 14 0	5 10 0
No. 3.—Cereal and vegetable manure	Colonial Sugar-Refining Co., O'Connell-street.	9	3·3	4	10	13	2	....	2	6 13 0	6 10 0
No. 4—Orchard and flower manure	Colonial Sugar-Refining Co., O'Connell-street.	8	4·9	6	8	11	2	....	4	7 7 0	7 10 0
No. 5.—Vineyard and potato manure	Colonial Sugar-Refining Co., O'Connell-street.	8	3·3	4	8	12	2	....	7	7 12 0	7 10 0
No. 6.—Pea and clover manure	Colonial Sugar-Refining Co., O'Connell-street.	9	·8	1	11	14	2	....	7	6 16 0	6 10 0
A.—Phosphate manure	Colonial Sugar-Refining Co., O'Connell-street.	2	....	....	7	....	12	8	....	3 8 0	3 0 0
B.—Turnip manure	Colonial Sugar-Refining Co., O'Connell-street.	8	1·6	2	6	....	14	6	1	4 15 0	4 5 0
C.—Pea and clover manure	Colonial Sugar-Refining Co., O'Connell-street.	7	·8	1	6	....	14	6	3	4 18 0	4 15 0
D.—Orchard, vine, and vegetable manure	Colonial Sugar-Refining Co., O'Connell-street.	7	1·6	2	6	....	12	6	4	5 5 0	5 0 0
Ohlendorff's dissolved Peruvian guano	Gibbs, Bright, 37, Pitt-street	8·5	5·74	6·97	7·43	11·78	....	....	2·06	6 18 0	*14 0 0
Albert's concentrated superphosphate	Jepson Bros., 75, York-street	16·35	....	....	2·34	20·25	26·85	....	....	10 15 0	12 5 0
Albert's concentrated horticultural manure	Jepson Bros., 75, York-street	16·01	11·12	13·50	1·78	11·15	4·42	....	22 20	16 16 6	23 0 0
Albert's Thomas phosphate	Jepson Bros., 75, York-street	....	....	....	....	....	12·26	5·24	....	3 2 0	4 5 0
Thomas phosphate	Jules Renard, 306, Kent-street	....	....	....	6·23	....	7·63	13·02	....	3 3 0	6 0 0
Odam's superphosphate	Holdsworth and Macpherson, George-street.	12·82	....	....	3·58	15·8	1·1	1·29	....	5 0 0	6 10 0
Odam's dissolved bone	Holdsworth and Macpherson, George-street.	6·40	1·96	2·38	5·70	8·73	2·54	5·27	....	4 12 0	8 10 0
Odam's complete manure	Holdsworth and Macpherson, George-street.	10·01	3·50	4·25	7·54	10·42	·36	1·29	5·48	6 15 0	10 10 0

* Price for 5 tons and over.

Waste-products, Ashes, &c.

Manure.	Where obtainable.	Water.	Volatile and Combustible.	Nitrogen.	Ammonia.	Insoluble.	Lime.	Phosphoric Acid.	Potash.	Value.	Price asked.	Remarks.
										£ s. d.	£ s. d.	
Residue from Sanitary Furnace	Municipality—Orange	4·11	11·04	·49	·59	42·18	8·50	4·64	2·77	1 13 6	1 18 0	
Deposit from wool-scouring tanks 1	Liverpool Wool-scouring Works.	....	....	·04	·78	....	....	....	·72	0 11 6	......	
2	" " "	....	....	1·02	1·24	....	....	·16	·30	0 14 0	......	
3	" " "	....	....	1·37	1·66	....	....	·14	·20	0 16 9	......	
Sheep-manure	" " "	9·71	50·01	1·70	2·17	32·26	2·0	·01	·92	1 7 0	......	
"Scutch" from limed pelts	Hugh Wright, Auburn	5·32	73·42	1·30	2·18	3·61	9·30	·89	·20	1 3 6	......	
Decomposed hair and lime	Fellmongery	9·70	57·08	6·36	8·33	1·22	26·27	....	....	3 17 0	......	
Bat-deposit	Cave Flat, Cooradigbee	5·43	12·98	·50	·61	57·64	5·00	12·12	....	1 16 0	......	
Tan-yard refuse	Tanneries, St. Mary's	6·43	33·83	2·24	2·72	21·43	26·06	·67	....	1 7 0	......	
Filter-press muck	Cane Mills, Broadwater	16·39	26·07	·22	·27	34·86	13·20	5·08	·44	1 14 0	......	4·94 per cent. phosphoric acid, soluble in water.
Megass	Clarence River cane	22·86	67·32	·63	·78	8·61	·30	·01	·05	0 7 6	......	
Megass ash	" "	....	....	....	....	87·69	3·07	·17	·51	0 3 6	......	
"	Richmond River cane	....	....	....	....	....	1·11	·28	4·70	1 9 3	......	
Bloodwood-ash	....	....	....	....	....	....	8·47	·27	5·25	1 12 3	......	
Iron-bark	....	....	....	....	....	....	....	·82	1·53	0 11 0	......	
Blackbutt ash	....	....	....	....	....	....	7·27	·04	2·02	0 12 0	......	
Red-gum ash	....	....	....	....	....	....	....	·38	4·17	1 0 0	......	
Spotted-gum ash	....	....	....	....	....	....	....	·10	·70	0 4 3	......	
Boxwood-ash	....	....	....	....	....	....	....	·67	1·65	0 11 9	......	
Seaweed-ash	....	....	....	....	....	....	9·27	·49	·59	0 4 9	......	
Ash of kerosene shale	Hartley Vale	1·49	27·93	·70	·85	67·59	....	·28	·14	0 9 3	......	
Cave-deposit, shells, &c.	Cowan, Hawkesbury River	2·11	....	·82	·90	....	35·40	1·59	·88	0 18 3	......	
Flue-deposit	Maitland	....	....	....	....	83·75	2·56	·32	·31	0 10 6	......	
"	Liverpool	....	....	....	....	91·17	·42	1·20	·17	0 4 0	......	

Practical Vegetable-Growing.

Directions for the Month of August.

welve months have now passed since these directions for vegetable-growing ere begun, and it is pleasing to know that they have been of considerable sistance to several of the readers of the *Agricultural Gazette* who have ken the trouble to follow the advice given. It is greatly to be regretted, owever, that but little attention is given by farmers generally to the growth vegetables, and indeed they are but too often neglected altogether. The ltivation of but a few kinds even might be made not only profitable, but teresting, and when interest is but once aroused the number of varieties ill be increased, and the quality of the vegetables improved.

Readers are again reminded that thorough preparation, good drainage, d frequent and proper cultivation are necessary for the production of getables of the best quality. Manure of the best kind for vegetables ould never be wanting on a farm. A mixture of the droppings of all imals (except the pig), burnt bones, and vegetable rubbish, well rotted gether, forms a manure that cannot be excelled. Wood ashes should be eserved, and spread over the garden as they accumulate. The space to be t apart for vegetables need not be very large, but it should be kept entirely art for them, away from fruit or other trees, and should be open, bright, d sunny.

Take every opportunity to prepare for spring sowing and planting, for ring next month nearly all the tender sorts of vegetables may be sown, en in the coolest climates. Make a thorough clearing away of rubbish, ch as old cabbages, peas, and useless vegetables of all sorts. When these ve been cleaned off, spread a good dressing of manure, and dig it in, taking re to dig the beds as evenly and level as possible. Nothing can be worse an a bed all heaps and hollows, and it requires but little practice to dig ell, if proper attention is given to it and the work be not too much hurried. uring the month the following vegetables may be planted and sowed :—

Asparagus.—Roots had better be planted as soon as possible, because efore long, and especially in the warmer parts of the Colony, the buds or oots will begin to start into growth. It may be stated for the benefit of ose who know nothing about asparagus that two or three years must apse before the shoots should be gathered for use, but after the plants are ufficiently matured they will be productive for many years, provided they eceive an annual dressing of manure, and the land had been well dug and repared before the asparagus was planted. As stated in the gardening irections for this month last year, "It prefers light, warm soil, but this is ot absolutely necessary for the production of good shoots. A dressing of ung (say 3 or 4 inches) should be well mixed with the surface soil to the

depth of about 6 inches. When the ground is quite ready for planting, di holes about 6 inches deep, and large enough for the roots to be spread ou evenly without touching the sides." Keep the centre of the plant an inc or two higher than the ends of the roots. This can be done by raising th soil in centre of the hole, making a little sort of mound as it were. Fill i with fine soil by hand, and firm it well down, but take care not to break o injure the fleshy roots. The crown of the plant should be about 2 inche below the surface when covered up. The plants should stand from abou 2½ to 3 feet apart. A dozen or eighteen plants will give a fair supply o "grass," when they have become well established. If plants cannot b procured, the intending grower will be obliged to sow seeds and raise h own plants, and the work of sowing had better be done some time durin September or early in October. Keep the ground quite free from weeds, a this is an important matter during the early growth of asparagus.

Artichoke, Jerusalem.—Before it is too late, obtain some tubers and pla them out in trenches made about 6 inches deep, and 3 feet apart. Drop t tubers along these trenches, about 1 foot apart, and cover with fine soil. Th ground, before making the trenches, should be well dug, well drained, an well manured. This plant belongs to the same family of plants as the su flower. The tubers are wholesome and nutritious, and should be grown b everyone who can obtain tubers. It will grow in any kind of soil, and co sequently is generally neglected, and the produce is but small, but if we looked after the yield will be considerable. When the stems begin to with away towards winter the roots may be gathered for use, as they may b required.

Beans, French or Kidney.—As this is a vegetable generally well liked, a comparatively easy to grow, when the frosts are over a few rows should b sown in the warm parts of the Colony. Where there is danger of frost it not worth while risking the sowing, as the vegetable is tender and cann stand frost. Dig the ground well and manure freely, adding some lime afte wards if it can be obtained. Superphosphate of lime is a good addition farmyard dung, but sulphate of ammonia, nitrate of soda, or any spec manure containing nitrogen, should be avoided. Potash would be most us ful, and for this wood ashes may be used freely. Sow the beans in ro 2 feet 6 inches or 3 feet apart. Make drills about 3 inches deep, drop the beans from 4 to 8 inches apart, and cover with fine soil, firm down wi the back of a spade, and keep quite free from weeds.

Beet, Red.—A row or two of this vegetable should certainly be grown everyone who has a garden. It is best not to apply manure for this pla for if the ground be freshly manured the beet is liable to become fork and badly shaped. Use, therefore, ground that has been well manur from some other vegetable. Sow the seeds in drills 18 inches apart, a about 1 inch deep. Cover the seed by hand with fine soil, and firm do with the back of a spade. When the plants come up and are 3 or 4 inch high, thin them out by degrees to about 9 inches or even a foot apart.

Beet, Silver.—A useful vegetable, which is grown for the leaves, and n the root. Manure the ground well with farmyard dung, and then sow t seed in the same way as directed for red beet. Thin out the plants well about 18 inches apart, and keep them free from weeds.

Broccoli, Brussels Sprouts, Cabbage, Cauliflower, Savoy.—These vegetab require much the same treatment, and are therefore classed together. Th belong to the same family, but have been altered by selection and cu

ation. Make small seed-beds, digging the soil fine, and keeping it as level s possible. Sow a little seed thinly in small drills about 2 inches apart. he Brussels sprouts, broccoli, cauliflower, and Savoy will be found to ucceed best at this season of the year in the coolest parts of the Colony. Vhen plants are available, they may be planted out from 2 to 3 feet apart, ccording to the richness of the soil. The richer the soil, the wider apart ne plants should stand. The ground should be well dug and well manured. n order to produce good cabbages, cauliflowers, &c., the seedling plants hould be lifted carefully from the seed-beds, taking care not to break their oots. They should then be planted out carefully, kept well weeded, and ell cultivated frequently.

Celery.—Sow some seed in a small carefully-prepared seed-bed, or in a box of ood fine soil mixed up with some old dung. The box should be well drained, nd holes should be made in the bottom to allow surplus water to get away uickly. Make little drills with your fingers, about half an inch deep, drop the seed thinly, and cover over with fine soil. Do not let the soil become ry, and shade, if necessary, from the sun, but let the shading be light, and emove it before the plants grow much, otherwise they will become weak and drawn." When the plants have grown to a height of about 2 inches, move iem to a small bed which has been well prepared and the soil made fine. hen plant out in this bed, about 3 inches apart, the young seedlings when ey have grown to a height of about 2 or 3 inches, and they will develop to strong sturdy plants, ready for transplanting into trenches. Celery eeds abundance of manure and good supplies of water.

Carrot seed may be sown largely in soil that should be prepared in the me way as that recommended for red beet. Sow in rows about 1 foot art. The seed being provided with small hooks, is apt to stick together; erefore, before sowing, rub it well with sand, and this will cause it to parate. Carrot seed takes a long time to come up, and unless the beds e kept well weeded the young plants may be smothered. When old iough to handle, thin out well.

Leek.—A most useful and wholesome vegetable well worth the growing. requires rich soil, plenty of moisture, and abundance of manure. The ound should be well drained. Sow a little seed in a seed-bed, and when e seedlings have grown to a height of 6 or 8 inches they may be transanted. The seed should be covered very lightly with soil—in fact, barely vered.

Lettuce.—Sow a little seed in a seed-bed, and plant out the seedlings when ey are large enough to handle. If plants can now be obtained, they ould be planted out. Do not break the roots more than can be avoided. anure the ground well with rotted dung before planting. In warm stricts it may be advisable to sow the seed in rows about 1 foot apart, and t transplant. This will stop, to some extent, the tendency of the lettuce "bolt" or run to seed before it makes a good heart.

Melons, Cucumber.—Seed may be sown in warm spots, where the young ants can be protected from frosts. When all danger from frost is past, e seedlings may be transplanted out to the garden.

Onion.—Sow seed largely of this important and wholesome vegetable. rain the ground thoroughly, and manure heavily with rotten dung. Then ake the surface fine and level, and sow the seed in drills about 12 or 15 ches apart. Be very careful not to sow the seed too deep, but merely ver it with fine soil. On no account allow any weeds to grow, or else the

seedlings will soon be ruined. When the plants come up and are fai strong, thin them out to 6 or 8 inches apart. Make the beds narrow facilitate weeding.

Parsnip.—Sow largely in drills as was directed for beet-sowing. T ground should be dug deep, but it would not be advisable to apply manur

Peas.—Should be sown largely in well-prepared ground that has be well manured with rotted dung. Avoid the use of manures containin large proportion of nitrogen, such as sulphate of ammonia. If artific manure has to be used, apply superphosphate of lime two parts, and kai or potash manure, one part, at the rate of about a large handful to square yard. Fine ground bone-dust is a good manure to apply, a lime, rubbish, and wood ashes are useful. Sow the peas in drills, abou feet apart, and cover with about 3 inches of soil. The peas should not be so closer together than 4 inches. As soon as the peas are well up above ground put in sticks along the rows to support the plants from trailing o the ground. Keep the ground between the rows frequently hoed.

Potato.—Plant a few rows of a kidney variety, the early rose; or if th cannot be procured, try any other kind available. Dig the ground w manure it well, and drain well. Use farmyard dung, which can be impro with a little sulphate of ammonia and potash manure, kainit. Make rows about 3 feet apart, and put in the potatoes about 1 foot apart, 5 o inches deep. Use fair-sized whole potatoes in preference to cut sets.

Radish.—Sow a few rows of various kinds in soil made rich with very w rotted manure.

Rhubarb.—This is a most useful plant to grow. It needs rich, heav well-drained, and deeply-dug soil. Plant out roots, if they can be obtain 3 or 4 feet apart. The crown of the plant should be about 2 or 3 inc below the surface of the soil when covered up. If plants are not ea obtainable, seed may be sown next month, but the plants will not be re to put out for some time.

Turnip.—Sow a little seed in drills, about 1 foot or 15 inches ap Cover the soil with not more than an inch of fine soil. Manure with sta dung, superphosphate of lime, or fine bone-dust.

Tomato.—Sow a little seed in a warm, sheltered place and protect fr frosts. When there is no danger from frosts, seed may be sown in garden without protection, and if plants can be obtained they should planted out.

Orchard Notes for August.

DurING the month the planting that has not been already done must be ompleted, and the same care and attention must be exercised in the planting s has been previously described in these notes. When set out, the young rees must be properly headed back, so that the young growth may be strong nd vigorous. By neglecting to cut back sufficiently hard at planting, the uture strength, vigour, and symmetry of the tree is greatly impaired.

The pruning of deciduous (summer) fruit-trees must be completed during he month, and where the main crop of oranges and lemons has been gathered hese trees may receive the pruning they require—that is, the removal of ead or superfluous branches, and the shortening in of excessive or straggling rowths. Thorny mandarin-trees should be well thinned out, as a good early pruning will result in a strong yearly growth of new wood, on which he succeeding year's crop of fruit will be grown. Thus, instead of having n excessive crop of small-sized fruit one season and little or no fruit the ext, regular crops of fine fruit will be produced.

August should be a busy month for spraying, and spraying is an operation hich is just as essential in nearly every orchard in the Colony as is the athering of the fruit.

All winter sprays to destroy scale insects—red spider, &c.—on summer uit-trees, should be completed during the month, and where citrus trees re badly affected with either the red, white, mussel, or glovers scales, the uit should have been gathered, the necessary pruning done, and then the ees should be well sprayed with the resin, caustic soda, and fish-oil wash. he black and broad scales would also be destroyed by this treatment, but ey can be easily destroyed at any time by means of the kerosene emulsion, pecially if a starch solution is added, so as to form a film or skin over the ales, which peels off when dry, taking the scales and their attendant magine or smut fungus along with it. Winter-sprays on citrus trees ust be applied before the young growth and blossoms appear. Towards e end of the month the first sprayings with Bordeaux mixture for e shot-hole fungus or scab of the apricots, the Windsor pear blight, nd the apple scab, should commence in the earlier districts, and the ot-hole of the almond and cherry should also be prevented by the same eans. Rust and curl-leaf in peaches and nectarines, though not entirely revented by Bordeaux mixture, are often greatly checked by its application. uring the month the black aphis on the peach, nectarine, Oriental Japanese) plums, and occasionally apricots, should be carefully hunted out nd killed wherever found. As these insects infest the roots, as well as the ranches, it is advisable to fork a little hot lime round the roots of the trees nfested, which will generally dislodge them, and all that are hybernating on e under-side of the smaller branches should be destroyed by spraying with he resin and soda-wash—two or more sprayings being given if necessary.

Just previous to the flower-buds bursting a cotton or linen banda
be tied round the trunk of the tree, and the bandage should be sme
a sticky substance (not tar, this injures the tree) which will pr
wingless insects that remain in the roots from getting to the branch
oil, boiled till it becomes sticky, and then applied, should answer
would not dry readily. If the aphides are thus kept thoroughly
during the winter months the trees will be enabled to get a st
insects in spring, as the time that they do the most damage is j
buds are bursting, and a little later. If the insects can be check
first three weeks or a month there is no more trouble, as the eightee
lady-bird (*Leis conformis*) will then keep them in check. The woo
or American blight, should also be carefully attended to. Full part
this insect, and also of the best methods of combating it, appear in
part of the *Gazette* under the heading of "Apple Culture," so I
to what I have stated there. If not already done, a careful sear
be made for the larvæ of the codling moth, and all that are found d
Scrape off all the loose bark of infested trees and burn, and carefull
all cracks or crevices, as the insects always hide in the snuggest
places they can find. Carefully examine the fruit-store, and also
that have contained infested fruit—immersing the cases in boiling
ten minutes will kill all the larvæ present, and also the spores
injurious microscopic fungi.

The cultivation of the orchard during the month will be confi
use of the plough. All weeds should be turned under, and the g
into condition for the spring cultivation. This applies more to the
tricts of the Colony than to the coast, as in the drier districts,
several times pointed out, the success of fruit-growing will depe
much on irrigation as on retaining the moisture in the soil by a
cultivation, which prevents in a great measure surface evaporation.
the end of the month, and during September, soluble manures, suc
phate of ammonia, nitrate of soda, nitrate of potash, sulphate o
superphosphate, the Colonial Sugar Company's manure, Albert's
and others should be applied, as the trees being in active growt
them at once, but care should always be taken when applying highl
trated soluble manures not to apply too much at once, but rather a
often, and to apply along with them a more slowly soluble manur
bone-dust, blood, and bones, or boiling-down refuse, so that when th
stimulating effects of the soluble manures are exhausted the plant
have the more slowly available manures to fall back on.

General Notes.

Potash and Ammonia in Potato Growing.

Vith a view to testing the efficacy of treating potatoes by soaking them ı a mixture of nitrate of potash and sulphate of ammonia, in New South Vales the following experiment was recently carried out by an officer of the epartment at Pennant Hills. The mixture was prepared by Mr. Guthrie, hemist to the Department, in the proportions set forth as having succeeded the French experiments, details of which appeared in the *Gazette*, vol. iv 66.

Three weeks prior to planting, the portion of ground selected was oroughly worked over with the fork. Two days later it was treated to a ir sprinkling of bone-dust worked in with the hoe and subsequently kept ean. The planting took place on the 19th February last. There were ree trenches prepared, each 18 feet long. It was considered that a trench this length would comfortably hold fifteen sets; consequently, out of lf a bushel of potatoes of the Early Puritan variety supplied by the incipal of the Hawkesbury Agricultural College, three lots each of fifteen hole, sound potatoes of about the same size were selected. One fifteen s soaked for twenty-four hours in the mixture above mentioned, another teen was, at the suggestion of the chemist, soaked in rain-water for the me period, the remaining fifteen being planted in the ordinary way with-t any treatment. In order to insure better drainage, the weather having r some time previously been very wet, and the soil being a heavy loam, the enches were dug 4 inches deep. Each trench was then given a good sting of fresh wood ashes, after which the potatoes were put in at equal tances apart and covered with soil. The rows were carefully pegged and rked.

The first shoot appeared in the untreated row on the 8th March, seventeen ys from planting, and later in the day the first shoot appeared in the row ated with plain water. The weather from time of planting was very wet d muggy. The first shoot in the chemically-treated row appeared on e 10th March—two days later. Weather still wet, and continuing so, til practically the end of March, after which it changed to fair, with an casional shower, until time of digging—26th May.

When all shoots which were likely to appear were well above ground, it s found that of the row chemically treated no less than eight sets had tted, and the seven which had grown were rather weakly. Of those nted without any treatment fourteen strong shoots resulted, while of the ter-treated there were twelve fair plants. The potatoes, on being dug, owed the following results:—

Chemically-treated—9 tubers, all very small.
Water-treated—40 tubers, 20 large and 20 small.
No treatment—40 tubers, 20 large and 20 small.

From these results it would appear that in a heavy loam and in we
the chemical treatment is not a success with this variety, while t
treatment appears fairly satisfactory, giving an equal result fro
plants to that from fourteen untreated plants. From results wh
obtained from the same variety with an early sown crop, it woul
that the Early Puritan is not suitable for late sowing in the Penr
district.

Pyrethrum.

Owing to the kindness of Dr. P. Stanich, the well-known aurist, th
ment is in a position to distribute small quantities of the seed
insect destroying plant, which that gentleman has recently
from Dalmatia. This plant grows readily in New South Wale
addition to being fairly ornamental, may be put to many uses in d
various kinds of insects. It would be of peculiar value to all per
keep poultry. A small quantity dried and rubbed small, and place
nests, would not only drive out any lice which might be present, b
also prevent their entrance. With more careful treatment it b
valuable assistant to the housekeeper, and it has been proved th
plants among growing roses assist greatly in driving off the n
insects which attach themselves to these plants. In addition to p
the seed, Dr. Stanich will be pleased to give information regarding t
and preparation to anyone who will call upon him, either at 145, 1
street, Sydney, or at Penrith.

Improved Production of Caramel for Colourin

At a meeting of the Royal Agricultural and Commercial Society o
Guiana, Georgetown, British Guiana, held on Thursday, 8th Ma
the following resolution was adopted:—"That the sum of 200 d
paid from the funds of the Society, on the award of its Agricultu
mittee, to such person or persons as shall, by the 30th of Septem
inform this Society of some improved way of producing caramel—
with its economical manufacture—for colouring rum for market,
ducing the least degree of obscuration."

In accordance with the above resolution, Mr. Thos. Daly, the Ho
tary, invites communications, to be addressed to him not later than
of September next.

AGRICULTURAL SOCIETIES SHOWS, 1894.

Society.	Secretary.	Date.
apto A. and H. Society	A. B. Chippindale	Jan. 9, 10.
lunes Agricultural Society	J. W. Brown ...	„ 17, 18.
lbion Park A. and H. Association	T. Armstrong ...	„ 17, 18.
iama A. and H. Association	J. Somerville ...	„ 25, 26.
olt–Sutherland H. and I. Society	W. Douglas ...	„ 26.
ollongong A. and H. Association	A. J. A. Beatson...	„ 31, and Feb. 1.
rry A. and H. Society	A. J. Colley ...	Feb. 6, 7, 8.
sford A. H. and I. Association...	H. S. Bevrendge...	„ 9, 10.
ddenham A. and H. Association	K. Campbell ...	„ 13, 14.
nning River (Taree) A. and H. Association ...	W. Plummer ...	„ 14, 15.
thgow A. and H. Society	M. Asher... ...	„ 15, 16.
oalhaven (Nowra) A. and H. Association ...	R. Leeming ...	„ 15, 16.
ladulla (Milton) A. Association...	C. A. Cork ...	„ 20, 21.
arulan P. and H. Society	H. Morrice ...	„ 23.
ngaroo Valley A. and H. Society	H. Joyce	„ 25, 26.
ndelo A. and H. Association	C. H. Brooks ...	„ 27, 28.
mut A. and P. Association	W. H. Bridle ...	„ 27, 28.
nterfield P., A., M., and H. Society	J. Harker... ...	„ 27, 28, and Mar. 1
rt Macquarie A. and H. Society	A. E. Poutney ...	„ 28 and Mar. 1.
more A. and H. Society...	C. S. Connor ...	„ 28 and Mar. 1, 2.
rrima District (Moss Vale) A., H., and I. Society	J. Yeo	Mar. 1, 2, 3.
pean District (Penrith) A., H., and I. Society	R. Benaud ...	„ 1, 2, 3.
bertson Agricultural Society	R. J. Ferguson ...	„ 6, 7.
alla P. and A. Association	J. D. Leece ...	„ 6, 7.
ga A. and P. Association	A. J. Wilson ...	„ 7, 8.
erell P. and A. Association	J. M'Ilveen ...	„ 8, 9.
ton Agricultural Society	G. Bradbury ...	„ 8, 9.
okwell A. and P. Association	H. J. Peard ...	„ 8, 9.
bargo A. and P. Society...	J. Graham ...	„ 13, 14.
mberumba P. and A. Society	W. Willans ...	„ 13, 14.
en Innes P., A., and M. Association	J. Denshire ...	„ 14, 15.
ulburn Agricultural Society	J. J. Roberts ...	„ 15, 16.
lgong Agricultural Association...	C. E. Hilton ...	„ 16, 17.
midale (Combined Show), A. and P. Association	W. H. Allingham	„ 20, 21, 22.
ralga A. and P. Association	J. J. Walsh ...	„ 21, 22.
yal Agricultural Society (Sydney)	F. Webster ...	„ 21 to 27.
aidwood P. and A. Association...	G. F. Taylor ...	„ 22, 23.
stle Hill A. and H. Association	F. H. G. Rogers...	„ 26, 27.
ange A. and P. Association	J. S. Thomas ...	„ 28, 29.
alcha P. and A. Association	H. Chapman ...	April 4, 5.
wer Clarence (Maclean) Agricultural Society...	J. S. Dunnet ...	„ 4, 5.
mden A., H., and I. Society	W. R. Cowper ...	„ 4, 5.
ndagai P. and A. Society	W. E. Kyle ...	„ 5, 6.
ayney P. and A. Association	G. H. Woolly ...	„ 5, 6.
ndaroo P., A., and H. Association	J. Affleck	„ 6.
amoi (Narrabri) P., A., and H. Association ...	J. Riddle	„ 11, 12.

Society.	Secretary.	Date.
Bathurst A., H., and P. Association	W. G. Thompson..	April 11, 1
Clarence (Grafton) P. and A. Society	T. Page	,, 18, 1
Wellington P. and A. Association	R. Porter	,, 18,
Hunter River (West Maitland) A. and H. Association	W. C. Quinton ...	,, 18, 1
Dubbo P., A., and H. Association...	G. H. Taylor ...	,, 24, 2
Warialda P. and A. Association	W. B. Giddes ...	,, 25, 2
Mudgee Agricultural Society	J. M. Cox ...	,, 26, 2
Williams River (Dungog) A. and H. Society ...	....	May 2, 3.
Coonamble P. and A. Association...	F. R. Salt	,, 2, 3.
Macleay (Kempsey) A. and H. Association ...	H. R. Gray ...	,, 9, 10
Gwydir (Moree) P. and A. Association	J. G. Cohen ...	,, 9, 10
Hawkesbury District (Richmond) A. Association	C. S. Guest ...	,, 11, 1
Upper Hunter (Muswellbrook) A. and H. Association	Price Healey ...	,, 16,
Upper Manning (Wingham) A. and H. Society...	J. J. Herkes ...	,, 16, 1
Central Australia (Bourke) P. Association ...	J. P. Martin ...	,, 23, 2
Cumnock P. and A. Association	W. Newmarch ...	,, 24.
Brewarrina P. and A. Association...	H. L. Cathie ...	June 5.
Nyngan P. and A. Association	E. H. Prince ...	,, 20, 2
Warren P. Association	F. C. Thompson ...	,, 7, 8.
Cobar P. and A. Association	A. Roxburgh ...	,, 13, 1
Deniliquin P. and A. Society	H. J. Wooldridge	July 19, 2
Hornsby, Thornleigh, Pennant Hills, &c., H. Association	H. Epthorp ...	,, 23, 2
Riverina (Jerilderie) P. and A. Society	J. Fulton	,, 24, 2
Hay P. and A. Association...	F. W. Blanche ...	,, 26, 2
Condobolin A. and P. Society	W. H. Garnsey ...	,, 31 an
Narandera P. and A. Association	J. F. Willans ...	Aug. 2, 3
Forbes P., A., and H. Association...	W. G. Dowling ...	,, 9, 10
Corowa P., A., and H. Society	A. A. Piggin ...	,, 15.
Northern (Singleton) Agricultural Association ...	C. Poppenhagen ...	,, 15, 1
Parkes P., A., and H. Association	H. S. Harwood ...	,, 15,
Grenfell P. and A. Association	G. Cousins ...	,, 16,
Horticultural Society of N. S. Wales	E. S. Sautelle ...	,, 22, 2
Burrangong (Young) P. and A. Association ...	C. Wright ...	,, 23, 2
Moama A. and P. Association	C. L. Blair ...	Sept. 4, 5
Cowra P., A., and H. Association...	S. Wright... ...	,, 5, 6
Murrumbidgee P. and A. Association (Wagga)...	H. T. Davidson ...	,, 5, 6
Queanbeyan P. and A. Society	E. C. Harris ...	,, 11,
Burrowa P., A., and H. Association	J. F. Clifford ...	,, 13,
Albury P. and A. Association	G. E. Mackay ...	,, 13,
Burrowa P., A., and H. Association	J. F. Clifford ...	,, 13,
Junee P. and A. Association	M. H. Davis ...	,, 19, 2

Secretaries of Societies are asked to forward dates of forthcoming Show as decided.

[4 plates.]

THE

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11*b* 109—94 (*a*)

CONTENTS.

Sida rhombifolia, Linn.

(Syn.: S. retusa, Linn.)

(11b109-94)

"Queensland Hemp or Paddy's Lucerne."

Paddy's Lucerne or Queensland Hemp.

(*Sida rhombifolia*, Linn. Syn.: *S. retusa*, Linn.)

An Australian Weed with great possibilities of Usefulness.

By J. H. MAIDEN,
Consulting Botanist.

Other Vernacular Names.—It is of course not a hemp, nor is it confined to ueensland, but let that pass. It sometimes goes by the name of "jelly-f," on account of its mucilaginous character, which causes it to be nibbled stock.

Botanical Name.—This plant belongs to the natural order *Malvaceæ*, or llow family, which includes a multitude of fibre plants. The earliest name it is *Sida rhombifolia, Linn.* Theophrastus gave this name to an aquatic nt supposed to be identical with *Althæa*. *Althæa* includes such plants as marsh-mallow and hollyhock. *Rhombifolia.*—From the shape of the ves, which are more or less rhomb-shaped in the original forms.

Synonym.—The original scientific name of the plant is, as has been already ted, *Sida rhombifolia*, which includes a number of forms, one of which been named *Sida retusa*. As the name *Sida retusa* has got such a firm d on the minds of Australians, almost as firmly in fact as the vernacular es, I would have proposed to adhere to the name *Sida retusa* in this paper, ept for the fact that the plant has already been referred to in the *Gazette* ler the name of *S. rhombifolia*, and to adopt another name now might se confusion in the minds of farmers.

Flowers.—It has a yellow flower about half an inch across, which is only y expanded for a few hours in the middle of the day, and is very difficult preserve.

Fruit.—This will be readily made out from the figure. It is brown when , and the cup-shaped calyx contains a number of awned seeds.

Leaves.—Rather rigid; the shape will be readily made out from the figure. has been already stated, the leaves, particularly when young, are more or mucilaginous, a property shared in common with other plants belonging he natural order Malvaceæ; hence the use of some of them, *e.g.*, marsh-llow, as demulcents.

Size.—In warm, congenial situations, as on the northern rivers, it attains eight of several feet, with a stem thicker than a man's finger; but in the ghbourhood of Sydney, and further south and west, it is a very much aller, scrubby shrub, rarely attaining a height exceeding 3 feet.

A

Distribution.—The warmer coastal districts of New South Wale particular, and as far south as the Illawarra. It is an Australian na which of late years has assumed a very aggressive character, and has trav south, even invading the Blue Mountains and Southern Ranges, until it nipped with the cold. But it is undoubtedly developing increased resist to cold, and is slowly encroaching on localities in which at one time it c not obtain a footing. About the suburbs of Sydney it may often be no by the sides of the roads and footpaths. After it has been a great pe a district for a few years it gradually diminishes in luxuriance, and fi almost dies away, as if it had exhausted the sustenance it requires fron soil.

Paddy Lucerne, in one or other of its forms, is to be found in the wa countries of both hemispheres, but I am not aware that circumstanc any country cause it to be such a pest to agriculture as it is in Ea Australia.

A Grafton correspondent writes:—"It grows here only too luxuria and is a perfect nuisance on some grass lands. One of the Grafton p is entirely overrun with the pest, and this is the condition of many padd in the district. No difficulty need then be apprehended as to its succe culture if it could be made a commercial product."

A telegram to the *Sydney Morning Herald* of the 17th March, 1892, Nowra, states:—"The Municipal Councils of the district are co-oper in the extermination of a noxious weed known as *Sida*. Cattle eat it the weed destroys the natural grasses. Some years ago it began to sp between Kiama and Gerringong, and now hundreds of acres have rendered useless by it. The weed grows strongly, and is difficult to ext nate. In many cases a plough will not reach the roots."

Propagation.—From seed, of which it bears an enormous quantity anything is to be done with this plant as regards utilisation of its fibre below) it must be cultivated. This matter is dealt with further on.

Paddy's Lucerne as a Fodder Plant.

Stock eat up the tops of it without detriment, if in moderation; but it be exceedingly indigestible if eaten in quantity, on account of its fib nature, while the ripe seeds are hard and prickly, and therefore irritatin think its value as a fodder plant is unconsciously exaggerated, for, u there be plenty of grass (in which case the Paddy's Lucerne is not req at all), cattle are always liable to injury through eating this fibre plant.

Paddy's Lucerne considered in its twofold aspect as a Noxio Weed and a Fibre Plant.

This plant is sadly too well known by land owners on our northern r and in Queensland, and the very mention of Paddy's Lucerne awakens pa reflections, for it has rendered vast areas of excellent land largely unfi pastoral and agricultural purposes. Property holders keep it down a as they can, but when it once gets a firm hold of the land it is practi impossible to eradicate it, for it yields abundance of seed, which germi freely.

Paddy's Lucerne is, in a word, a pest, a noxious weed, and there i doubt that northern land owners (and even Parliament, as being a m almost of a national character), would be willing to pay a very handsome

its extermination could be guaranteed. In such a way is the Prickly Pear *Opuntia*) dealt with; but Paddy's Lucerne is not an utterly useless plant ke the Prickly Pear and the Bathurst burr, for, as is well known, it contains really valuable fibre, besides having some value as a fodder, as already dicated. There is no doubt of this, for its value has been proved over and er again, and at the present time it actually forms one of the innumerable -called "hemps" sent from India to Europe. I have had excellent fibre ade from New South Wales and Queensland plants in my keeping for ars, and the samples are as good as, and better than, those obtained from Indian source. The pleasant prospect thus presents itself: Can the uble advantage be reaped of ridding the land of a pest (or rather of eping it within bounds), and at the same time making a useful article of mmerce out of it? The tempting problem has been so often attacked—t with failure, on account of the costliness of the process employed—that man who attempts to tackle it now starts with prejudice against him, and htly so.

I proceed, however, to give a preliminary account of a process by an nerican gentleman, who appears thoroughly to know what he is talking out. The samples referred to in the correspondence are in the keeping of e Department, and they will be shown to persons interested, and the name d address of the gentleman will be furnished on application. It will be tinctly understood that I guarantee nothing: the process is at present a cret, and the plans of the inventor (inventors are usually a sanguine body men) may be unconsciously tinted with too much *couleur de rose*. I ing it forward purely on public grounds, and do not hesitate to say that ere ought to be some means devised of giving the process a fair trial.

At the late Melbourne Exhibition I drew the attention of Mr. Griffin ur late United States Consul), to the possibilities of Paddy's Lucerne as a elder of fibre, showed him some samples, and gave him a few particulars ncerning it. That gentleman put what I told him in his own words, and bodied it in his report on the Exhibition which he transmitted to the partment of State. The report was published, and attracted the attention my correspondent at Atlanta, State of Georgia, U.S.A. Now, I may be cused when I remind my readers that not only is this State largely in-ested in cotton, but also very deeply in other fibres, chiefly in regard to gging for the cotton. In fact, the State is one of the world's fibre centres; thentic information in regard to these substances is there readily obtain-le, and the words of my correspondent demand respect. It will be best allow his words to be recorded varbatim:—

"I have a new method of decortication, and seek to enlist you in an terprise for the establishment of a plant at some suitable place in Australia ich, while being of benefit to the projectors, might establish a valuable lustry for your people. . . . I ask you to put me in correspondence th some one in your country who would be interested in the best, most peditious, and cheapest process in the world for decorticating fibrous ants and rendering the results into marketable shape. The process is the covery of a citizen of this place, with whom, as to this correspondence, I interested. He is now in Mexico, erecting for the Director of Agricul-ral Affairs of that country a plant for the reduction of Ramie, in which at country is largely interested. It is probable that with a good prospect success the writer would visit your country, for we should ask for very tle before demonstrating success as to our ability to quickly and cheaply duce to such fibre as is enclosed (sample sent); but I leave it for you to y how it could then be disposed of, and how much and amount of probable

profit. The seeds of Paddy's Lucerne which you furnished Mr. Griffin w
sent me and planted, growing to maturity, and were shown Mr. ——.
Mexico he found the same plant growing wild, some of which he subjec
to his process, and the results are herewith enclosed for your inspection,
I also enclose his letter to myself relating thereto. Fibrous plants
Paddy's Lucerne can be reduced to fibre in from 6 to 10 hours at a cost
not over 3 dollars per ton for the cost of decortication. What the expe
of gathering the weed for transportation to the plant would be, in additi
I do not know. As you are on the ground, you are the better judge of
extent to which this business might be carried on in Australia or s
countries as trade with you, nor can I guess the probable demand thro
such business channels as may flow to or from you."

Extract from second letter from correspondent of the first letter. I
not publish the name, as I have not been asked to do so:—

"State of Vera Cruz, Motzorongo, Mexic

"Find enclosed some fibre I extracted to-day from the Paddy's Luce
It is no trouble to treat successfully and with great economy. This w
was done on a small apparatus. When my large plant is arranged I wil
much better work, and send you better specimens. You can write y
Australian friends that you can find the best process in the world."

Nearly three months afterwards my correspondent again writes:—

"While at so great a distance it is difficult to absolutely prove my st
ment to the entire satisfaction of those interested, yet I will again say
we have so far demonstrated the facts here, in reducing all of the kn
fibrous plants to merchantable fibre, that to us not a doubt remains tha
can do everything stated to you, and even more. To us, therefore, it is
a question of how to profitably dispose of the fibre when manufactu
and, although I realise why you are cautious and sceptical, we only wis
know if it can be sold, and a profitable business can be established wher
weed grows profusely. If so, we can produce the fibre for less than
sum stated to you heretofore, and, besides, with a rapidity hitherto unkn
The real question is as to the amount of Paddy's Lucerne to be had at rea
able cost, and are you so situated geographically that it can be sold
your locality in large amounts? Rest assured that we can do our
easily, and in the manner heretofore detailed to you."

There is no "climbing down" in this letter. The writer remains as ea
in this matter, and as confident of treating Paddy's Lucerne, as he was
two years previously to my knowledge. I am fully aware that there i
particular difficulty in preparing Paddy's Lucerne fibre. I have had beau
samples done in the colonies for years, and have received quite a numbe
others from correspondents on the Richmond and Clarence; but a pr
to be successful commercially must be cheap, and the guaranteed co
treatment mentioned is marvellously low.

There are two main points to be discussed which are raised in the a
quoted letter:—(1) Can the fibre be sold? (2) The amount available

1. In regard to the first, certainly the fibre can be sold. I can
samples of the same fibre from India, picked out of lots sold in the Lo
market; and I may be excused reminding my readers again that the
forms part of the so-called Indian Hemps. Like other fibres, its price
with the degree of preparation and other circumstances; and I have
samples of our colonial-made Paddy's Lucerne fibre to London for valu
I received a reply from the Assistant Director of the Royal Gardens at
to whom I had sent a sample of the fibre prepared by a friend (an ama

n the Clarence River a few months ago. The letter is as follows:—"We re in receipt of your letter and of the specimen of *Sida* fibre. This has een before us so long ago as 1872, when specimens were received in this ountry from Queensland for the Exhibition of 1872 (*Journal Soc. Arts*, ec. 13, 1872, p. 69; also, *ibid*, Dec. 12, 1873, p. 67). As a consequence of e attention called to *Sida* fibre in Brisbane by Mr. Staiger, we have an tract from a local newspaper, stating that an order had been received (in hat year is not mentioned) from an English manufacturer for 3,000 tons, £30 per ton. We have no record of this order having been fulfilled. It probable that nothing came of it. As regards your specimen, we sub- itted it to Messrs. Ide and Christie, and I have pleasure in enclosing their ply. It is not very encouraging; but if some simple machine could be ocured for cleaning the fibre, on a commercial scale, there is no doubt a arket could be found for it." (The American process I have been advo- ting clears away this difficulty.)

The letters from Messrs. Ide and Christie, the leading London brokers r fibres of this class, referred to in the foregoing, is now given:—

"We have Mr. Jackson's (Curator of the Kew Museums) favour of 23rd stant, with sample of fibre of *Sida rhombifolia*, or *S. retusa*, from New uth Wales. This fibre, commercially, belongs to the jute class, and would used for similar purposes. Although we have frequently had small mples of *Sida* before us (we reported to you on specimens from India in nuary last), no merchantable quantities have ever been received, to our owledge, in London. In some respects we consider it inferior to jute, tably in the interlacing of the fibres, which we think characteristic of all res of the *Malvaceæ*. This defect would probably make itself felt in eparing the fibre for spinning. Your specimen otherwise is good, soft, d well-coloured, and to-day, relatively to the market value of jute, would mmand £16 per ton in London."

It will be observed that in the letter of the Assistant Director of the yal Gardens at Kew there are two references to reports in the *Journal the Society of Arts of London*, at the time that attention was prominently wn to the fibre, about twenty years ago. In order to make this account *Sida* fibre as complete as possible, I now give extracts from these reports. me of the fibre was sent to London to the International Exhibition of 72:—

'With reference to *Sida retusa* (*rhombifolia*), which was shown in the last ernational Exhibition, Messrs. Noble, the well known fibre-brokers, report follows:—We have examined the fibre. It will be of great value, pro- ed there is a large quantity that may be sent from Queensland; so that s worth the while of spinners to devote themselves to it. There is in the e value of upwards of £30 per ton, if sent clean and free from woody lk. We would recommend you only to steep it, and crush out as much of wood as possible, and send it. It will then bring from £11 to £12 per , and it will rise in value according to the way it is cleaned; but, as our is scarce, we think it is the best way to send it rough at first. If you l that labour becomes more plentiful you can clean it more. The difference sists in the amount of labour expended, when probably understood, and ing of expense in freight in what would be wasted; but do not trouble rself about it unless plenty can be produced in the country, as little lots uld not bring their real value. To show you that quantity will be sure to rk its way, we may mention one article of similar though inferior quality— e, from India. Thirty-seven years ago a little was brought into this untry—only about 3,000 bales a year of 300 lb. to the bale—and it was

pronounced as worthless, except for adulterating; but I recommen
come in quantity. It has made for itself a market, made the for
Dundee, and last year there were imported 1,600,000 bales."—(*Jou*
the Society of Arts, December 13, 1873, p. 69.)

Exactly one year later there appeared in the same journal a lett
the late Mr. K. T. Staiger, of Brisbane, to the Minister of Public W
the northern colony. Mr. Staiger's remarks, as given below, refer to
mental cultivation of the plant, and he concludes with suggestions a
methods of experimentally preparing the fibres. These additional
have not given, for the reason that they are now superseded by th
American process I have referred to. Those, however, who wish to
full text of Mr. Staiger's letter will find it in the *Journal of the So*
Arts, December 12, 1873, p. 67, which may be found in the Free Pu
other libraries.

"The principal aim in making fibre would be to aim at the produ
a branchless or nearly branchless plant. This would facilitate the
tion, and allow the introduction of machinery. Therefore, a be
100 ft. x 100 ft. of best soil should be well prepared, and the *Sid*
(*rhombifolia*) sown thereon as thickly as possible. This would, to
deal, hinder the plant from shooting out branches, and so make
adapted for fibre-making. The plants when ripe should be cut, the
let grow again, so that the actual yield of a good tilled acre per y
not of one cutting alone, could be ascertained."

Therefore, the fibre is a valuable one. Secondly, there is a pra
unlimited market for it; London alone can take far more than Aus
ever likely to send her. Thirdly, we have a cheap process for the extra
the fibre, which largely disposes of the question of comparatively hig
labour. Only one thing remains, and that is for Australia to prod
weed. If we cannot, or do not choose to do so, there is an end
matter; but as soon as abundance of the raw material is availa
American friends are willing to come here almost immediately and
at what appears to be a ridiculously low cost; and what simplifies m
good deal, they do not require a bonus or pecuniary help of any sort

2. As to the supply available: On the Richmond it has spread
everywhere, and in some localities it grows to a great height on eve
side. On the Clarence also it has been an acknowledged nuisance f
years past. In favourable localities it grows to a height of 3 to 4 o
feet, with a stem an inch in thickness. As has been already obse
spreads over paddocks, and frequently seriously diminishes the v
agricultural land. And here I make an important quotation from
from Mr. T. Bawden, of Grafton, well known as an authority
particular matter:—

"As to the Paddy's Lucerne, I am glad you are working in the d
of utilising this plant; but there are one or two questions that
consideration. The plant in its nuisance form is unsuited for fibre p
It is usually eaten down and browsed over until it becomes a heavy-
stunted shrub. In certain places when stock cannot get at it it gro
and would be suitable for treating; but those places are not numer
are so far apart that it would scarcely pay to cut and collect the
conveying it to a central factory for treatment. My opinion is
anything is to be done with Paddy's Lucerne as a fibre plant, it will
be properly cultivated. And then comes the question—Will it b
profitable to turn the rich lands of this (Clarence) district from m
sugar-cane growing to *Sida* growing? That, of course, can only be an

by calculating labour and yield annually in connection with rent. The latter ranges from 20s. to 50s. per acre in the parts more suitable and accessible to a central place for treating the removed plant. Of course, there are parts of every farm where a patch of *Sida* might be grown, in addition to the ordinary crop, and without interfering with it; but, if so, the question would depend upon amount of labour as against return."

Has any reader any knowledge of an experimental patch of Paddy's Lucerne being grown on the Richmond or Clarence? I am more than ever convinced that the plant is not a mere worthless weed, but rather one which has simply got the mastery, for a time, owing to its adaptability to various soils and situations. The position of affairs reminds one of the homely saying, "Fire is a good servant, but a bad master."

I think I have shown that the question is worthy of serious attention by the public of New South Wales. It should be no difficult matter for some of our Northern residents to give an idea of the probable extent of land affected with Paddy's Lucerne, where it has spread most, and to give any other information in regard to it, in order that preparations may be made for a public trial on a large scale.

The question of paddy's lucerne fibre is important, for on it may turn the whole subject of the growing of fibres in this Colony.

Previous Australian Experience with the Fibre.

This subject has already been touched upon, but the following additional information will be of interest.

Mr. W. Hill, late Colonial Botanist of Queensland and Director of the Botanic Gardens, Brisbane, in his annual report for 1873 to the Legislative Council, gives the following information in regard to Queensland Hemp (*Sida rhombifolia*, Linn.):—"A sample of the material manufactured from this plant was exhibited at the International Exhibition held in London in 1862, and commanded great attention. The sum of £35 per ton was offered for it in large quantities, according to sample, and it was anticipated that an increased demand would raise the price to £60 per ton. So many inquiries were made to me on the subject that, at my private expense, I imported two machines from England, at a cost of £100, which I was led to believe would answer the purpose of dressing the fibre so as to render it saleable; unfortunately they turned out to be quite unsuitable for that object. A sample of the fibre was also shown at the London International Exhibition last year, and since then I have been inundated with letters on the subject. Such questions have been put as the following:—If a company were formed would they be able to find 5,000 acres of land suitable for the cultivation of this special product, and where would it be situated? What would be the produce per acre were the land properly cultivated? Do you know of anyone who understands the cultivation of fibre-producing plants, &c.? It is to be regretted that the great demand for a fibre of a plant which grows as a weed in Queensland, and is becoming a pest to the farmers, cannot be better supplied. Late advices inform me that small lots of Sida are saleable at only from £14 to £17 per ton."

From the report of the Victoria Royal Commission on Vegetable Products, I note that a sample of the fibre was shown to Mr. James Miller, rope-maker, of Melbourne, and pronounced by that gentleman to be suitable for engine packing, or any kind of string, clothes lines, and ropes, or it could be woven into anything. It is highly probable it could be used for fishing lines. Mr. A. M'Pherson, of Brisbane, says of it:—"It comes to maturity from seed in six

months. It takes four months water-retting to produce the fibre. The germinates if kept eight years. By means of suitable machinery it cou spun into a fine yarn, if reduced almost to the state of pulp. The fib very light. It would not produce more than 700 lb. per acre."

Mr. M'Pherson showed samples of Queensland grown jute and *Sida r* fibre at the Colonial and Indian Exhibition, where they were examine the fibre specialist, Mr. C. F. Cross. Mr. Cross speaks of the jute as " fine specimens," and states that while it and the *Sida* are similar in main characteristics, the *Sida* is unquestionably superior (an observ contrary to that of Ide and Christie above).

He goes on to remark:—"*Sida* shows superiority in point of unifor fineness, and divisibility of the fibre bundles, and further, in softness a the colour of the raw fibre; and also, in capacity for bleaching. The d capacity of the fibre is about equal. The net result of the comparis that, while belonging, with jute to the lower grade of textile fibres, *S* much to be preferred and should certainly displace jute, more especia the higher uses to which this fibre is put. As we are informed tha plant grows luxuriantly in the Australian climate, there is a very s case already made out for calling the attention of the authorities t question of the production of the fibre. It may be mentioned that the was pitted against jute of "unusually good quality."

Reference to plate:—(1) Section of a Flower; (2) Early Fruit; (3) Calyx (5- and 10-ribbed); (4) Carpels ("seeds") with two awns.

J

A New South Wales Bitter Vine.

(*Piptocalyx Moorei*, Oliv.)

. Mild Romance in Australian Economic Botany.

By J. H. MAIDEN,
Consulting Botanist.

the 28th November, 1892, I received a note from Mr. J. P. Dowling, icultural Editor of the *Sydney Mail*, stating:—"I have received the losed from New England, close to Guy Fawkes. It is a creeping vine or ıt, known as 'bitter vine.' A settler is about to make a dye with it, is collecting a ton of leaves for the purpose. What is it, and what is r opinion?"

'he leaf was ovate-lanceolate, had the tip broken off and also the stalk. eturned answer that I required a flowering or fruiting twig. I kept the f and the note, hoping for further specimens, but they were not forthning. Guy Fawkes is over 400 miles north of Sydney, in the Snowy nge, in very sparsely settled country, and I had almost given up hope of ring anything further about the leaf. But on a recent official inspection the Don Dorrigo Forest Reserve, undertaken for the Forest Department, I urned to Sydney, *viâ* Armidale, and hence stayed at bleak Guy Fawkes, ere I did some collecting. I there met a gentleman who gave me a good ıl of local information, assisted me with horses to the top of the Round ountain, and took a good deal of interest in my work. [For an account the trip, see the *Gazette* for April last. The descriptive list of the plants lected will appear in next month's *Gazette*.]

It was not, however, until my return to Sydney that I remembered the f of November, 1892, from the Guy Fawkes district. In March last I sted the leaf to the gentleman referred to above, who replied, under date th April, "I send you a piece of the bitter vine, but I am very sorry to y it is not now in bloom or seed, but I will send you some of the blossom er on. This was grown at Diamond Flat, about 14 miles from here, on e head of George's Creek, a tributary of the Macleay. Pettroy (where I lieve your leaf came from), is 4 miles from this, on the same water. I ar it also grows on the Jeogla Hill. In the scrub it grows to a height of feet up the trees, but in the open, only to 3 or 4 feet. Mr. —— whose ople are dyers in England, is now collecting the leaves, and sending them me for use in the business. A halfpenny per pound is paid for picking em in the green state, and a handy man or lad can pick about 150 lb. per y. The vines will only stand stripping every other year. —— has thered four or five tons of leaves, and is gathering now."

I wrote to the gentlemen who are collecting and shipping the leaves. ey also stated that the leaves are used in England for dyeing, but I have

not their permission to make other interesting statements containe
letter public.

The twig sent by my correspondent was, as he stated, destitute
and fruits, and as he promised me these, I kept the twig under o
on my work-table, waiting for the necessary material.

On the 4th July the English mail brought me the *Pharmaceutic*
of 26th May, 1894, and my attention was at once attracted by
entitled: "*Piptocalyx Moorei*, Oliv.," by E. M. Holmes, Curat
Pharmaceutical Society's Museum. Mr. Holmes had received cert
from Australia offered for use in brewing. After examining them
them to Professor Oliver, who first described the *Piptocalyx* re
and who at once pronounced the leaves to belong to that spe
article is so full of interest to us that I reproduce it here:—

PIPTOCALYX MOOREI, OLIV.

By E. M. Holmes, F.L.S.,

Curator of the Museum of the Pharmaceutical Society.

A few weeks since I received some leaves from Belgium, with the inquir
identify them. Subsequently I received another similar sample from a L
with the statement that they had been imported into Hamburg from Australi
offered as a material for use in brewing. A third sample which I had the op
seeing was received from a firm in this country, under circumstances in
probability that these leaves reached this country and were on their trial for
indicated. Under these circumstances it seems desirable to ascertain if possi
the plant yielding them was likely to be poisonous or not.

The leaves are lanceolate acuminate, with an obtuse apex about 7 c.m. lon
broad, of a thin, but tough and parchment-like consistence, somewhat shin
sides, and with the veins and even the veinlets extremely prominent on bot
very marked character in the leaf is that the margin, which is entire, is th
the veinlets running along it, so as to form a kind of double margin. The
principal lateral veins on the under surface of the leaf are furnished with re
simple hairs. On holding the leaf up to the light it is seen to be studded wit
translucent dots, variable in size, but all comparatively small. These do no
be oil receptacles, since the leaf has no aromatic taste. It is, however, inter
By these characters the leaf may be easily recognised.

The leaves possess considerable interest from a botanical point of view. O
a piece of the climbing stem to which they are attached, it was found tha
alternate, and a portion of the inflorescence showed that the terminal fl
raceme was hermaphrodite, the stigma being sessile and apparently fimbria
ovary contained one suspended ovule, whilst the lateral flower below it posses
only. On showing the material to Professor Oliver in the Kew Herbarium
recognised the plant as one that he had published some years previously und
of "*Piptocalyx moorei*, Oliv." The ripe fruit of this is unknown, and he p
placed the plant in the natural order Monimiaceæ, the habit of the plant b
Palmeria, a genus in the same natural order. The plant is very little know
sent to Kew from The Hastings River, by C. Moore, in 1867. It appears
May. It is therefore a remarkable fact that a plant so little known to bota
be imported into Europe as a commercial article.

The description of the plant is given in Bentham's *Flora Australiensis*, vo
as follows:—

Piptocalyx, Oliv.

"*Generic Characters.*—Flowers polygamous. Perianth tube or disc
segments, about six, nearly equal, in two rows, very deciduous. Stamen
filaments filiform; anthers oblong-linear, adnate, the cells distinct and paral
longitudinally; no rudimentary carpels in the male flowers. Hermaphro
with stamens as in the males, and a single carpel, with a single pendulous
ovule, and a sessile broad stigma. Fruit unknown. Woody climber. Leav
entire. Flowers in simple racemes, the males opposite with the term
hermaphrodite."

"*Piptocalyx moorei* (Oliv., in Herb., Kew).—A woody climber, of 30
(C. Moore), the branches, inflorescence, and principal veins on the under

leaves ferruginous, with rather long, soft hairs. Leaves petiolate, ovate-lanceolate, with a long narrow point, entire or obscurely crenate, rounded at the base, 3 to 4 inches long, rather thin, shining above, pale opaque, and minutely glandular, dotted underneath, the veins conspicuous on both sides. Racemes shorter than the leaves, the pedicels very short. Bracts small and very deciduous. Perianth-segments very deciduous, the outer ones ovate-orbicular, 1½ lines long, hirsute outside, the inner ones elliptical or obovate-oblong, thin, all more or less dotted with immersed glands. Stamens about 15, about 1 line long, the filaments rather shorter than the anthers; anthers tipped by a short appendage to the connective. Ovary, glabrous, oblong, about 1 line long."

It may be observed that the plant is not known to be poisonous, and that there is no reason to suppose that it is so. Nevertheless, the use, as a beverage, of a bitter material, of which the physiological properties are unknown, is to be deprecated until its chemical constituents have been examined.

Immediately on reading this article I examined the leaves sent from Guy Fawkes, and found them to agree in every respect with the published description of those of *Piptocalyx moorei*. The fruits are as yet unknown to science; but I am promised them by a friend on the spot, and they may be to hand by the time this article is in type.

On the 10th instant I received from the Department a communication from Mr. Samuel Lamb of our Department (a gentleman who never loses an opportunity of making observations in regard to the indigenous vegetation in any district in which he may be travelling). In sending a parcel of the leaves of a plant (which I at once noticed to be our *Piptocalyx*), he says:—"There is something in this Bitter Vine. ——— have sent several dray-loads of the dried leaves to Kempsey this season for shipment. I met one of the drays returning yesterday. It is reported that the leaves yield a mordant which fixes some dye, but . . . It may yield a dye, or, if I may judge from the sweetly aromatic bitter taste of the fresh leaves (which closely resembles that of the English Buckthorn), it has probably a medicinal value akin to the cinchona plant. . . .

"It occurs in its wild state only in belts within sharply-defined limits; a hundred yards from where I gathered these leaves there was not a vine to be seen. It appears to propagate chiefly from the root, and from year-old vines, which send down white fibrous roots into the decayed leaves which thickly cover the ground, on which they lie and trail, some to the length of several yards."

The leaves received from Mr. Lamb I had already begun to examine, with the view to ascertain their active principle, and then to take steps to have it tested physiologically but for the receipt on the 12th July of the *Pharmaceutical Journal* of the 9th ultimo, containing the following letter on the *Piptocalyx moorei*, over the well-known signature of John C. Umney:—

Piptocalyx Moorei.

"It may be well to put on record some results obtained in the preliminary examination of the leaves of the above plant, which were submitted to me about eighteen months ago for examination, as to the practicability of their employment as a bitter for beverage purposes. The quantity at my disposal was about a hundredweight, but, notwithstanding most careful search, no fruits or flowers could be found, and hence the identification of the drug was attended with considerable difficulty. Mr. Holmes' classification of the leaves as those of the above plant make the result of the examination of the more interest. The leaves have an intense but purely bitter taste, somewhat resembling chiretta, but are possessed of no characteristic smell. By aqueous infusion a very mucilaginous liquid was obtained, the amount of gummy matter present in the leaves precluding their use by direct extraction with

water. The aqueous infusion after purification gave no indica presence of alkaloids, but reduced Fehling's solution very ma exhaustion with alcohol an extract was obtained from which a bitter substance was obtained, which possessed glucosidal pro which I have subsequently succeeded in crystallising. Now that t source of the leaves has been determined, I propose to make a mo examination of this body, with a view to determining whether th of the leaves is on whole or part dependent on it."

As Mr. Umney has the plant in hand, I have stopped m examination of it, and I look forward to his results with a g interest.

As far as we know, the plant is rather local in distribution, bu ness of its leaves has long been recognized, and it goes under Bitter Vine. This bitter property is evidently being utilized in on the continent of Europe for beverage purposes (in brewing and the information supplied by my correspondents that it is dyeing is mistaken.

I emphatically endorse Mr. Holmes' caution, that the leaves be used for beverage purposes pending information in rega physiological effects. If it be a fact that any leaves have ente composition of beer, it may do the brewing trade a good deal o get abroad that a body of unknown physiological effects (such principle of *Piptocalyx moorei*) has been employed. It may bitter is quite harmless, but apparently no observations have bee

There is no record of the leaves having ever been emplo purpose in New South Wales, which, by the way, contains a bitter plants in its indigenous flora. I am prosecuting my inqu

Bentham, in the absence of fruits, provisionally places *Pipto* Monimiaceæ. I hope soon to get the fruits, and so to settle Meantime, a few notes on Australian economic species of Mon be useful.

Atherosperma moschata, the Sassafras of Victoria and Tasm bark which is used locally as a tonic by sawyers. An essential from the bark which is stated to have a lowering effect on the extract of the bark has been used in hospital practice in heart I believe its use is now discontinued.

The bark of *Daphnandra micrantha* is also used as a tonic, b Bancroft says ("Pharmacology of some Queensland plants," *Pr* Qd. iv, 1887), it contains the same alkaloids as *D. repandula*, his paper, "On the physiological action of *D. repandula*," pron poisonous. In a subsequent paper, he says, "The genus *Da* which three species are at present known, contains severa principles."

Doryphora Sassafras, our New South Wales sassafras is als aromatic tonic, and appears to be quite innocuous.

Boldoa fragrans (yielding "Boldo" leaves) has, in South limited use as a warm carminative tonic, especially in liver com

I think it will be generally conceded that whether our *Pi* prove to belong to the Monimiaceæ or not, it is very advisable results of further experiments before it be allowed to enter beverage.

It seems strange that we should have to go to the other end to learn to what use our indigenous vegetation is being put, cautious use of an untried plant may perhaps do the Colony so

...s on Colonial Timber for Carriage-building.

By J. H. MAIDEN.

... is undoubtedly an unwise prejudice in the colonies against colonial ...s for carriage-building, and this feeling is assented to by people who ... know better, and who ought to look into the merits of the timbers for ...lves. Instead of a man who orders a vehicle refusing to listen to his ...builder who suggests colonial timber, he should allow a conscientious ...xperienced coach-builder to exercise his discretion to some extent. ...adesman's reputation is at stake, and he will not trifle with it. It is ...fficult to see how such a state of things exists. Certain timbers in ...countries are approved for certain uses; it is easy to continue their ... a new country without troubling to ascertain whether a cheap, ...t, or even superior substitute is to hand. Some of our timbers have ... the experimental stage for carriage-building, and a user may run no ...ith them.

...the present time colonial timbers are less used in carriage-building ...they formerly were, owing to the excellent supply of English and ...can timbers in this market. Notwithstanding this competition, some ... colonial timbers are worthy of a more prominent position in the ...building trade than they receive. I am not so foolish as to advocate ...use for sentimental reasons, but I do not see why a timber should ... because it is colonial. Let it be used or not on its merits.

...ppose a timber could be put in no more trying situation than in one ... other of a carriage. In no trade is it more absolutely necessary that ... should be thoroughly seasoned than in that of carriage-building. ... inculcate this lesson in regard to colonial timbers. Let our watch-...n regard to them be, Season! Shun unseasoned timber as you would ... clothing. Nature has been so prodigal to the people of New South ... in regard to timbers that they sometimes lose sight of the fact that ... is timber after all, and that it is not ready for immediate use, like a ...of apples. Timber, each timber, has its season for cutting, just as ... has. Don't cut it all the year round, and then grumble at it if it ... and splits. Don't use it almost as soon as it can be converted into ...stuff, and then grumble at it if it twists or decays.

...son, season, season timber, or, in other words, give it fair play. I ...ce what I preach. I use large quantities of colonial timbers; in fact, ... them wherever I can, but never until they are well seasoned.

...ave jotted down a few notes in regard to colonial timbers for carriage-...ng, more as suggestions than anything else. I am collecting data as ... various colonial timbers used and deemed to be suitable to special ...; and I trust these few notes will provoke discussion, and cause

additional information *re* carriage-building timbers to be sent in. We are going to be more aggressive. We shall not be satisfied with the consumption of our native timbers by our own people, but we desire to foster a trade in them with other countries.

CEDAR (*Cedrela australis*, F. v. M.)

This is first and foremost amongst colonial timbers for carriage-building. Some grades of this, with clear, straight grain, dense and tough, make excellent framing for many of the parts of a carriage. In fact, I have been informed that Sydney cabs of excellent quality have been built of cedar alone, except the wheels and shafts. The features that recommend it for the special use of the carriage-builder are that it is light, and easily worked. It bends well for panels when seasoned. If a log be cut through the centre, then quartered, and flitches cut from each of these quarters, the result will be that panels even a quarter of an inch thick will not split at the ends more than an inch or so,—an important matter in an expensive and good timber. Mr. Samuel Lownds informs me that he examined some samples which had been exposed to the sun and rain, and also to the drip of water from a galvanized iron roof for a period of $3\frac{1}{2}$ years. The outer surface was almost unrecognisable, but the ends of the boards were neither split nor shaken. A board was planed up, and it had not deteriorated in the slightest, the colour and grain remaining perfect. Comparing cedar with the best English ash, the former timber remains sound under treatment which would cause the latter to be rotten. Our Sydney timber-merchants might be reminded that cedar which is left floating in the harbour deteriorates for the purpose of the carriage-builder. The salt penetrates the timber, and in best grade work the painting and varnishing suffers accordingly.

ROSEWOOD (*Dysoxylon Fraserianum*, Benth.), RED BEAN (*Dysoxylon Muelleri*, Benth.), and ONION WOOD (*Owenia apiodora*, F. v. M.)

Are timbers of the cedar class, for which they can often be substituted. Rosewood can be supplied in the greatest abundance, and the other two in lesser quantities. All three are really valuable timbers.

BLACKWOOD (*Acacia melanoxylon*, R. Br.)

This is a most useful timber for coach-builders, in the bent-timber branch. It bends well, and with proper treatment from the felling and sawing of the lumber, it substitutes perfectly for the bent timber in, say, an Austrian chair, and would look as well, and feel as light. For narrow boards it is used in the coach-building trade in Sydney in place of American walnut, and it is taken for that timber when polished. It is, in Sydney, only one-third the price of American walnut, which is an inducement for people to use it. It would last indefinitely in dry situations. It is really valuable for panelling, and perhaps framing.

COACH WOOD (*Ceratopetalum cepetalum*, Don.).

This is a useful timber to the coach-builder for placing in clean, dry situations. Under such circumstances, it is equal to English ash. Its weakness is its liability to rot when left in damp or dirty places near the bottoms of carriages, which are neglected and not kept clean. For very many years this timber has been in request for coach-building. An eminent coach-builder informed me that "it is the grandest Australian timber for coach-building." It is undoubtedly excellent for bodies, and a good all-round timber.

White Cherry or Coach Wood (*Schizomeria ovata*, Don.).

This is a closely allied and very similar timber to ordinary coach wood (*Ceratopetalum*), for which it is sometimes substituted. It is an inferior substitute, but a good timber, nevertheless.

Plum Wood or Acacia (*Eucryphia Moorei*, F. v. M.).

The name acacia is misleading, as it is not an acacia at all. It is a nice timber, with close, tough grain, and cuts well. It is capable of high finish in painting. It is a good all-round timber for body-making, if it gets fair treatment as regards being kept clean. I am assured that it stands the weather, wet and dry, very well.

In the Braidwood District this is rather extensively used, and much liked by coach-builders for the framework and bodies of buggies, spring carts, &c. It is also used for shafts and poles, being considered elastic enough for that purpose. It has also been tried for felloes, but has been found not to answer for that purpose. It does not yet appear to have been tried for spokes and naves.

Colonial Beech (*Gmelina Leichhardtii*, F. v. M.).

This is a very useful timber for panels and thin boards. It is pretty durable, but rather soft, but its softness is, in some instances, an advantage. Where extreme heat or moisture has to be considered, as in baker's carts, beech will be found to withstand such influences better than most timbers. It paints and polishes well, is very easily worked, and does not readily split.

Brown or Bully Beech (*Cryptocarya glaucescens ?*).

Has a good deal in common with colonial beech, but has the advantage that when cut into short lengths, it will stand nailing or screwing when many other timbers will go into splinters. It is not a strong timber.

Colonial Pine (*Araucaria Cunninghamii*, Ait.).

Is not fit for first-class work. It is used in wheelwright's work on account of its cheapness.

The quality, durability and reliability of colonial hardwoods (chiefly species of *Eucalyptus*), is well known. For cart and wheelwright's work there is no timber to approach them, though exception is taken to their weight. Put in such places as mentioned, no foreign timbers can approach them, viz.:—Ironbark and box for the naves of wheels, and very heavy dray-shafts; ironbark for spokes. Blue gum (*Eucalyptus saligna*, Sm.) is one of the best timbers for wheelwrights' body work; it is tough, not bad to work, and always gives two good edges for paint. For the felloes of wheels it is the best timber we have; the iron tyres seem to grip and adhere to them better than any other timber.

Grey gum (*Eucalyptus punctata* and others) can be efficiently used as a substitute for ironbark, both as regards strength and durability.

Spotted Gum (*Eucalyptus maculata*, Hook.).

Is strong and tough, and a useful timber for the coachbuilder. It is chiefly used for naves, and cart and buggy shafts.

MOUNTAIN ASH (*Eucalyptus Sieberiana*, F. v. M.—*E. virgata*, *Sieb.*

The excellence of this timber for general wheelwrights' work is everyw
admitted, and its quality on the whole appears to be less variable than
of the timber of most eucalypts. It is recommended for shafts, swingle-
of buggies, &c., and for miscellaneous purposes in carriage building.

MOUNTAIN GUM of N.S.W. or Spotted Gum of Victoria (*Eucalyp
goniocalyx, F. v. M.).

Selected timber of this species, grown on dry stony ranges, is value
wheelwrights, particularly for spokes.

APPLETREES (*Angophora*).

Selected pieces, free from gum-veins, used for naves, and, occasio
spokes, of wheels.

BRUSH BOX (*Tristania conferta*, R. Br.).

A tough and durable timber, extensively used in the north coast dis
for wheelwrights' work.

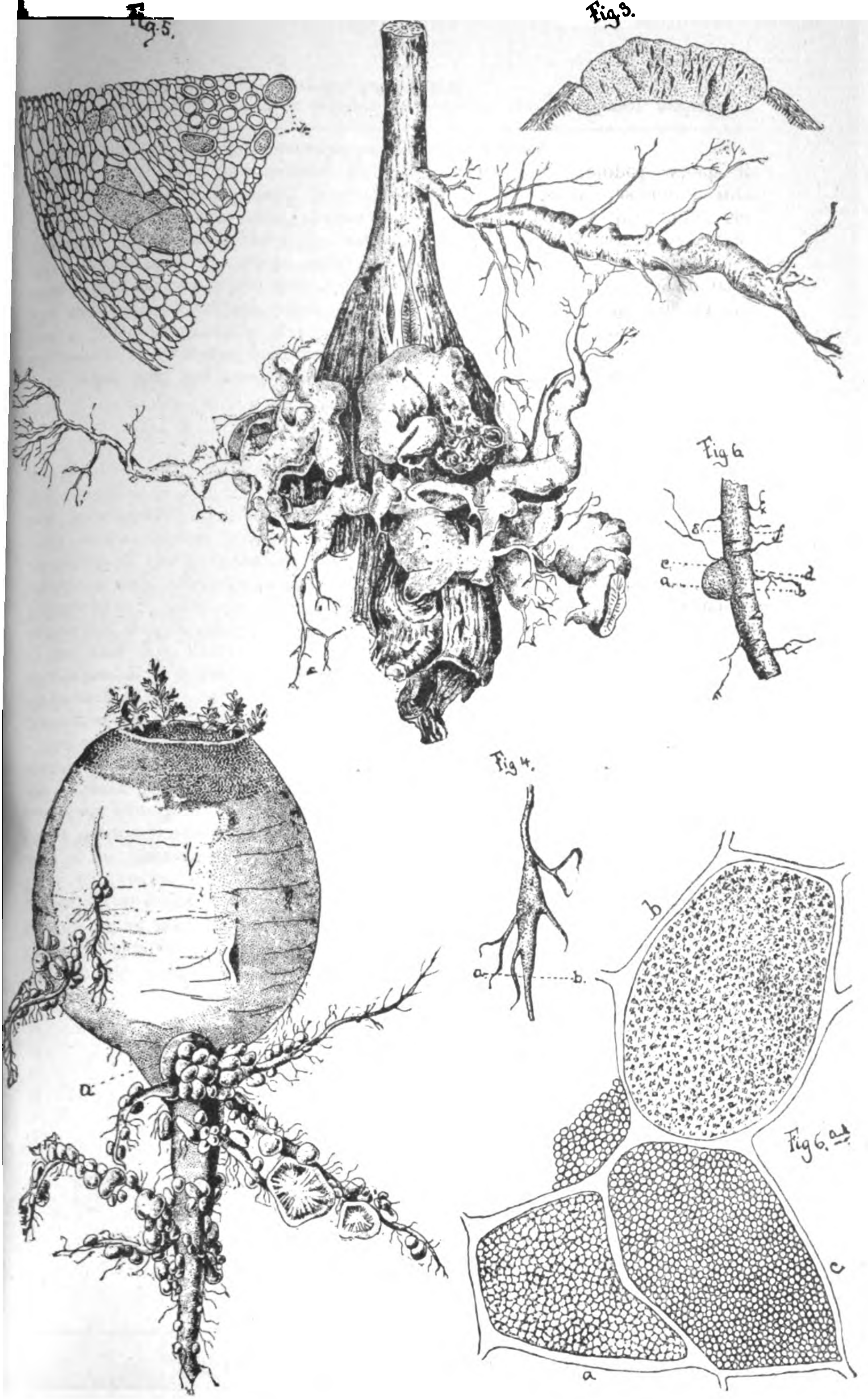
All the timbers above mentioned could be supplied in quantity, m
them in practically unlimited quantity. The list does not profess
complete; it has been compiled at rather short notice.

WILGA (*Geijera parviflora*, Lindl.)

Is used to some extent for the naves of wheels in the interior. O
commercial importance.

SPOTTED OR LEOPARD TREE (*Flindersia maculosa*, F. v. M.).

Unlike many other timbers in the arid western districts of New S
Wales, this timber is very elastic, and is, therefore, locally used for the
and shafts of drays, buggies, &c. Of no commercial importance.



THE CLUB-ROOT OF THE CABBAGE AND TURNIP.

Plate I.

Club-Root of Cabbage and its Allies.

By BYRON D. HALSTED,
Botanist and Horticulturist.

The club-root of the cabbage and turnip is an old enemy, having been known in Europe for more than a hundred years, and being a fatal malady, with peculiar and prominent characteristics, it has received one or more names, often quite descriptive, in several of our leading modern languages. Thus, in Germany it is called "Kohlhernie"; in France, "Maladie digitoire"; in Belgium, "Vingerziekt," and Russia, "Kapoustnaja kila"; in Great Britain it bears the names of "anbury," "hanbury," "finger-and-toes," and other equally expressive terms, while with us, "club-root," "club-foot," and "clump-foot" are the leading names for this trouble, the process being spoken of as "clubbing."

The injury to the crops attacked may be considerable, sometimes incurring almost a total loss, and in the aggregate the destruction for the whole country is doubtless represented by millions of dollars. It is particularly severe in the eastern portion of the United States, but is not unknown in the west and south, and during the past season (1893) has prevailed extensively in the truck regions around the large cities of New York and Philadelphia. New Jersey cabbage and turnip growers have suffered so heavily of late years as to suggest the subject as suitable for special consideration by the Experiment Station. Some facts with a practical bearing upon the question of how the club-root lives over from one year to another have been literally unearthed, which alone might warrant this publication. The weed plants that harbour this enemy, with engravings showing the pest, will be considered in their proper places later in this bulletin.

The Nature of Club-root.

In order that the reader may derive the most practical good from any suggestions as to use of preventives and other treatment of the disease, it is best to place before him the facts thus far obtained concerning club-root. The name of the malady is quite descriptive, for it is an affection of the roots, which become much distorted. The roots may begin to show enlargements while they are quite small and before the plants are more than seedlings. Thus, cabbages while growing in the hot-bed may show unmistakable signs of "clubbing," followed by a loss of vitality throughout the whole plant. The affected parts soon begin to decay, becoming very offensive, and, from places near by, other roots are developed, which, in turn, become swollen and distorted into various shapes.

This article is reproduced from Bulletin 98, issued by the New Jersey Agricultural College Experiment Station, U.S.A.—Ed. A.G., N.S.W.

Figure 1 shows three young cabbage plants taken from a field that was nearly ruined by the club-root. Instead of the numerous long fibrous roots, by means of which the plants are able to obtain the required nourishment from the soil, there is in each an extravagant malformation consisting of a much-knotted and enlarged root-system. The engraving of the three samples is from a photograph, and shows the general appearance so well that further description is unnecessary.

That which is of the most interest in this connection is the cause of the peculiar development and consequent destruction of the infested plants. As in nearly all instances of similar abnormal structures, these root-galls were long ago assigned to insects. A careful study of their development failed, however, to convict any species or group of insects of these depredations, and after much speculation, and no end of articles in the agricultural journals and elsewhere, it was reserved for M. Woronin, a European botanist, after three years (1873–76) of painstaking and exhaustive study, to explain the nature of the subject before us. From his published results* in particular and a recent paper† by Mr. A. C. Eycleshymer, the information as to the microscopic structure is largely obtained.

Instead of any insects being the cause, although such decaying masses usually become the breeding-places for them, Woronin found that a low form of fungus was constantly present in the affected parts. This parasitic organism is only seen with the higher powers of the compound microscope. The family of fungi to which it belongs, namely, the slime moulds, is widely distinct from the mildews, rusts, and smuts, and some of Woronin's and Eycleshymer's illustrations, as given in two plates which accompanied the latter author's paper and kindly loaned by Professor Galloway, are here reproduced, to make the nature of the club-root fungus clear. Ordinary fungi, like the grape mildew, corn smut, wheat rust and celery leaf-spot, have long, slender feeding threads which work their way through the tissues of the affected plant. There are no such threads with the cabbage slime fungus.

In Plate I., the first figure shows a specimen of diseased cabbage, natural size, and Figure 2 a "clubbed" turnip. Figure 3 is a portion of a section of a turnip-root, and Figure 4 is a rootlet of diseased cabbage, seven weeks after infection. At Figure 5 is shown a much-magnified view of a section of root (Figure 4) along the line *a*, *b*. A portion of a turnip-root, seven weeks after infection, is shown at Figure 6, natural size, and at 6, *a*, are shown cells from the section along the line *a*, *b*, of Figure 6, and 200 times magnified.

In Figure 5, scattered irregularly midway of the centre and circumference, are large cells filled with a slimy substance and differing from the other and smaller cells. These are infested with the slime mould, and, on account of tho presence of this parasite, the cells undergo remarkable enlargement, and an influence is communicated to the outer neighbouring cells so that the root becomes much swollen and even distorted. In its early stages of development the fungus is simply a semi-liquid substance within the cells of the root tissue; but as it reaches maturity the contents of the infested cells become granular, and finally they contain a multitude of minute spherical bodies, which are the spores of the mould. In short, this fungus, in the form of a slime or plasma, obtains entrance to the cells of

* Plasmodiophora Brassicæ. Urheber der Kohlphlanzen Hernie. Prmgs. Jahr. F. Wiss. Bot., Bol. XI, 1878, Plates 6.

† Club-root in the United States; Journal of Mycology, Vol. VII, p. 79, Plates 2.

Fig 9

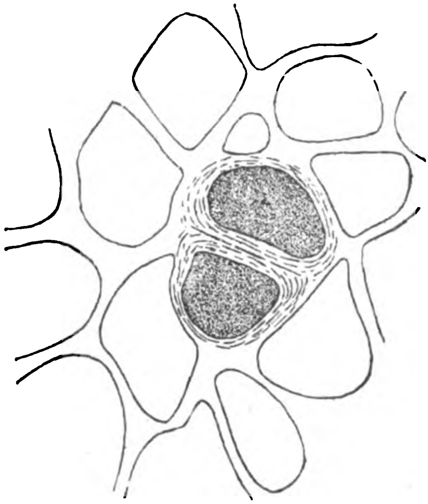


Fig 10

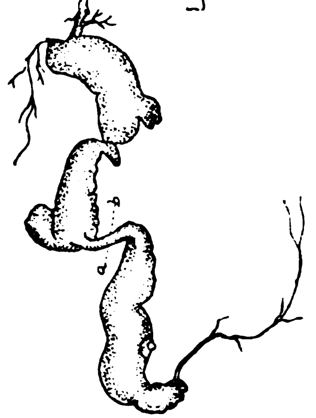


Fig. 12.

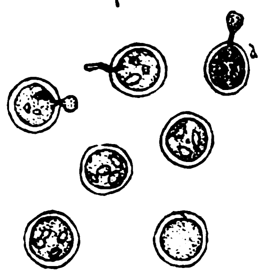


Fig 11.

Fig 13.

Fig 16.

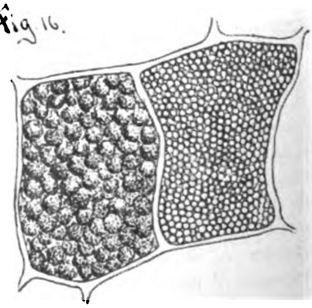
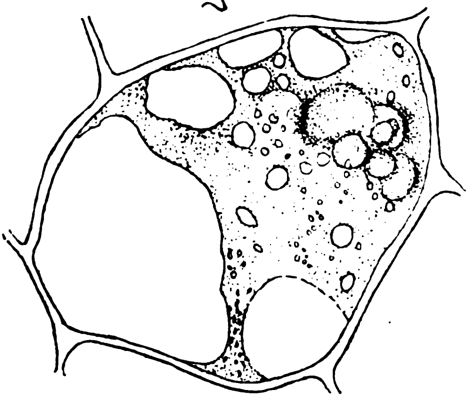


Fig. 14.



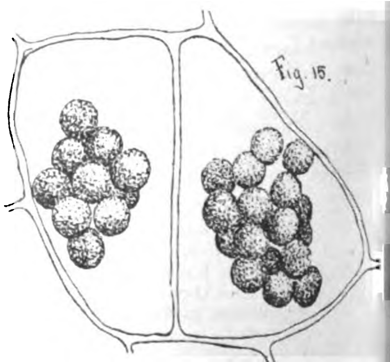


Fig. 15.

THE CLUB-ROOT OF THE CABBAGE AND TURNIP.

116 109 94

Plate II.

the growing root and there robs the infested tissue of its vital fluids, and, gathering new forces to itself, fills the cells with its own substance. This semi-fluid material then begins the process of spore formation, which results in the production of millions of minute bodies, each of which is capable of a new growth when conditions are favourable.

The three cells, *a*, *b*, and *c*, in Figure 6, *a*, help to show these peculiarities, but the second plate is devoted in particular to the points of development of the fungus. Thus, figure 9 is a portion of a section of Figure 10 at the line *a*, *b*, and magnified 600 times. The two cells shown shaded were completely filled with the plasma or slime of the mould. The spores which form from this semi-fluid substance are spherical, as shown at Figure 12, and in germination their contents come out as seen at *a*, becoming naked bodies, capable of movement and change in outline, the latter fact being illustrated at figure 11. These motile bodies may unite with their fellows and form masses of semi-liquid substance, as shown in different forms at Figure 13. A single cell of the cabbage-root is shown at Figure 14, in the early stage of the disease, magnified 600 times, while at Figure 15 are two cells later in the development and showing the formation of the plasma into spheres. Figures 16 shows the appearance of the fungus 200 times enlarged.

We have traced above the life of the obscure club-root parasite, from its appearance in the root as a slime in certain cells to the formation of multitudes of spores in these same cells. By the decay of the roots, which takes place rapidly, and with much offensive odour, the spores are set free in the soil. These spores there germinate by producing moving bodies, capable of penetrating or being absorbed by the thin walls of the hairs and other superficial cells of the roots. The soil becomes diseased in the sense that the germs, formed in the swellings and other distortions of the roots, are set free and the earth holds them for an indefinite length of time.

The Club-root in Weeds.

It is generally known to the students of the club-root fungus that it is not confined to the cabbage and turnip, and this leads to the statement of the botanical name of the parasite we have been considering. Woronin found it so different from all the other slime moulds as to warrant its being put in a separate genus, which he named *Plasmodiophora*—that is, the plasma or "slime bearer;" and, as it infested the cabbage and turnip, both members of the genus Brassica, he made the species *Plasmodiophora Brassicæ*, Wor. Since then two other species of the same genus have been discovered, namely, *Plasmodiophora alni*, Wor., upon alder-roots and *Plasmodiophora elæagni*, Schroet., on the roots of Elæagnus. Various works make mention of the club-root being found upon many species of the mustard family, but it is unfortunate that the particular species are not given. Saccardo* states that it is found in several cruciferæ (Brassica, rarely *Iberis umbellata*). Dr. Zopf† adds to these, "Levkoje"—that is, the Stock (*Mathiola incana*), also mentioned by Woronin. Sorauer‡ and Frank§ simply confirm the above statements. Eycleshymer|| says: "The plants affected are for the greater part confined to the genus Brassica, including

* Sylloge Fungorum, Vol. VII., p. 464.
† Die Pilzthiere oder Schleimpilze, p. 129.
‡ Pflanzen Krankheiten, Part II, p. 69.
§ Die Krankheiten der Pflanzen, p. 238.
|| Club-root in the United States; Journal of Mycology, Vol. VII, p. 49.

the cabbage, cauliflower, turnip, ruta-baga. Halsted has recently described it as occurring in the radish. In Russia it affects the genus Mathiola and Iberis."

So far as the actual species of the host of the club-root fungus can be determined from the books at the writer's disposal, the list is *Brassica oleracea* (varieties), *B. rapa*, *Raphanus sativus*, *Iberis umbellata* and *Mathiola incana*. This is only five species, the last three of which are known to be but rarely affected.

In view of these facts, it is interesting to add to the list two other genera, each with a single species, but both are among our most common weeds, namely, the shepherd's purse (*Bursa pastoris*, L.), and the hedge mustard (*Sisymbrium vulgare*, L.).

Figure 4 shows a group of the infested roots of the shepherd's purse. It must be borne in mind that the roots of this prevalent weed are not succulent, and the galls are correspondingly small. However, there is no difficulty in distinguishing a diseased from a healthy plant, even from the appearance of the plant above ground when thoroughly infested, it having a dwarfed and sickly-yellow appearance.

In Figure 5 is seen a similar group of the clubbed roots of the hedge mustard. The general appearance of these galls is quite different from those of the shepherd's purse, being more regular in form, standing out like dark warts from the otherwise well-shaped roots.

In this connection, to add to the information concerning the club-root upon our crop plants, an engraving each of the cauliflower (Fig. 6), turnip (Fig. 7), Brussels sprout (Fig. 8), and kale (Fig. 9) are added. They were all made from photographs by Prof. Smith, of fresh specimens collected by Mr. J. A. Kelsey. The cauliflower and cabbage resemble each other in the general form of the "club" that is produced, and in like manner the kale and turnip galls are somewhat alike. But there is no uniformity in the matter, and the size and shape of the malformations are largely determined by circumstances.

Precautions and Treatment.

From a consideration of the nature of the club-root fungus and a knowledge of the different kinds of plants infested by it, there may be some suggestions gathered as to preventive measures. When it is understood that the club-root and all the injury to the crop accompanying it is due to an internal subterranean parasite, it becomes evident that no treatment to which the infested plant may be subjected can give promise of a cure. Preventive measures must be relied upon, and, in the first place, all the refuse of a cabbage, turnip, or other infested crop, should be removed from the soil and burned. To leave cabbage stumps in the field, feed them to live stock or throw them in the compost heaps, are three of the best methods of propagating and spreading the malady on the farm. It is not enough to destroy the roots, for the Plasmodiophora is found also in the leaves, as Woronin took particular pains to show by means of an engraving in his paper.

Seedlings grown in the hot-bed should be examined carefully, and if they show signs of the club-root, consigned to the fire. If only a portion of the plants are clubbed, it may be wise to discard the whole lot rather than lose the crop in the field. Start with healthy plants.

In view of the fact that the soil may become more or less impregnated with the germs during the growth of a crop susceptible to the Plasmodiophora, it is evident that a wise precaution consists in a judicious rotation of crops.

Just what that rotation should be is a question for each grower to decide for himself; but, for the best results, cabbages or any allied crop should not be upon the soil oftener than once in three years. Cabbage, kale, Brussels sprouts, kohlrabi, turnips or radishes should not follow each other if club-root is prevalent.

It is possible to get relief by the use of some of the commercial fertilizers; but this needs confirmation through trial. It is a fact that is being acted upon in some of the large truck regions near New York, that lime is an effective preventive of the club-root, and, by its constant use, at the rate of 75 bushels or so per acre each year, cabbages have been grown at frequent intervals—almost yearly, upon the same soil. It is likely that a soil naturally abounding in lime may be the best suited for cruciferous crops, so far as club-root is concerned.

Lastly, it has been shown that common weeds harbor the fungus enemy, and, while the farmer may be thankful for the loss of his hedge mustard and shepherd's purse, through "clubbing," this is a case where weeds can be more cheaply destroyed in some other way.

Conclusions.

Club-root, an old enemy to cabbage and turnip in Europe, has been quite destructive to these crops in New Jersey during the past few years.

The malady is due to a microscopic parasite which infests the cells of the roots, causing them to become swollen and distorted.

The spores of the fungus, upon the decay of the part affected, become scattered through the soil, and from thence the enemy enters the host plant.

Plasmodiophora Brassicæ, Wor., infests several plants of the cabbage family, including turnip, kale, radish, stock and candytuft.

The common weeds, namely, shepherd's purse and hedge mustard, are now to be added to the list of plants infested with club-root.

Preventive measures must be relied upon, for the affected parts of a plant are below ground and not readily reached by any fungicide.

If the crop is diseased, all refuse at harvest-time of roots, stems, and leaves should be burned.

All seedlings from hot-beds with signs of club-root should be destroyed, and, if possible, use only plants from beds in which there is no disease.

Cabbage, kale, Brussels sprouts, kohlrabi, turnip or radishes should not follow each other on the same land if club-root is prevalent.

Lime added to the land, 75 bushels per acre, has proved effective. It is possible that some commercial fertilizers may be found to check the trouble.

Keep the land free from shepherd's purse and hedge mustard, and other weeds of the same family, as their roots become "clubbed," and thereby propagate the enemy.

Deep Cultivation.

By SIR A. COTTON,
Madras Engineers.

About forty years ago an old London wool-sorter, who had been puzzled by many things in the Australian wool trade, determined to go and investigate the matter on the spot.

On his arrival at Sydney he made a long tour through sheep stations, and when he returned he wrote to the paper an account of his tour, and ended by saying "One thing is certain, that the colonists know nothing upon earth about wool." As this subject of wool had been the only thought, day and night, of thousands of intelligent men for many years, this saying rather startled the people generally and offended them.

But one of the leading squatters asked him to come and see his flocks, which he did, and passed some thousands of sheep through his hands. The result was that the owner said, "I begin to think Mr. —— is right, and that we know nothing upon earth about wool." And certain it is that from that time a new era was introduced, and wool was brought to a degree of perfection, through the new principles laid down by this gentleman, that nobody had thought of before.

This is exactly the case of agriculture to this day in England. The whole body of those employed on the land know nothing upon earth about vegetation.

Innumerable papers have been written, especially of late, upon this subject, every one of them, without exception, based upon this false principle—that there can be no possible improvement in respect of quantity, quality, or price in the produce of the land. Of course if men start from a false premise they may discuss for ever without any useful result. How strange it seems that it should not occur to them that it is very curious that while everything else in the ordinary business of life has made progress beyond all that was imagined within this century, there should be this one thing which should have arrived at its ultimatum, and that no sane man can possibly dream of any improvement. How can we account for it that all connected with land, from the old owners of vast estates, men showing immense intelligence and energy in everything else, down to the small tenant, should all agree on this point—that whatever is going on before our eyes in all other matters, there can be no progress in cultivation.

And what makes a complete climax in the case is this—the very men who, by acting upon the principle that success is certain to everyone who sets

This lecture was delivered before the Balloon Society of London and is reproduced, as it opens the subject of Deep Cultivation, with which it is hoped to deal more thoroughly in a future issue.—Ed. *A.G.*, N.S.W.

himself earnestly to the thorough investigation of his business that he will make progress, have made themselves masters of vast wealth, and have laid out part of it in land, immediately take up the ground of established agriculturists, give up all their old principles, and proceed upon the ground of no possible improvement.

That I am not dealing in imaginations, but realities, I appeal to statements that are made by leading agriculturalists in the papers, expressly declaring that no improvement whatever has been made as yet. One of these states that after fifty years cultivation of good land it produces exactly the same, both in quantity and quality, as when he began, and his whole communication is written so as to imply that no improvement ever will be made.

And this is universally received as the truth of the case. Papers without number have appeared on this subject, without one protest against this view of the subject. Not one single writer says, "Then if you thus assure us that you are so profoundly ignorant of the first principles of agriculture that you have totally failed to advance one step in this art, we must of necessity look elsewhere for instruction." If it were possible to find a man who would write that he had been a director of a navigation company for fifty years, and that they were now carrying at the same speed, the same risk, the same consumption of coals, the same cost as when he began, what would be thought of him? What do such men say? They say, "We used to carry by sea at 8 knots, we consumed 5 tons of coals for 1 ton of cargo carried, we used to carry across the Atlantic at a cost of 20s. a ton, we used to lose such a percentage of lives carried, we used to be sometimes weeks behind our time in reaching port, &c. Now we cross, winter and summer, at 20 knots, we carry 1 ton of coals for 5 of cargo, we spend 5s. in carrying a ton of goods, we lose one-twentieth of the proportions of lives carried that we used to do; in dreadful weather our ships are sometimes twelve hours behind time, and so on.

This is substantially the change that has passed over the art of navigation.

And it truly represents the progress generally made in art and science excepting this one agriculture. What are we to think of this unaccountable state of things?

It must be observed that this, my line of argument, is simply an appeal to common sense. It is quite is quite independent of any theory of cultivation, or of any asserted results of new modes. We cannot possibly be wrong in coming to the conclusion that no reason can be imagined why one single art should be entirely without a possibility of progress while everything else, without exception, is astonishing us by a progress beyond all our dreams.

But further, are we entirely without actual results that flatly contradict the idea that this one art is beyond reach of improvement. Forty years ago the eighth Marquis of Tweeddale was driving me through a stock-yard, and he said, "Four years ago I got this farm into my own hands at the end of a long lease, and there is now four times the value of produce in this yard that there was when I came into possession." And at the same time the author of the "Book of the Farm," speaking of a field of the same estate, said to me, "I have seen a crop of oats cutting green on this field at Christmas; the land so poor, and sour, and cold, that some years oats wouldn't ripen on it. They have just now cut a crop of wheat of 40 bushels to the acre, weighing 67 lb.—the heaviest wheat in Great Britain." These were on land that had before been under the cultivation of the best farmers in Great Britain. And this was the state of things throughout 1,200 acres that his Lordship farmed

himself. Here in Midlothian, on a level of about 400 feet above the sea, with a mean temperature 5 degrees below that of the south coast of England, I saw crops of all kinds to which there was nothing approaching, all the way that I had come from the south coast. Mr. ——— wrote an account of this Yester deep cultivation, and published it, but I have never once seen it mentioned in all the innumerable papers that I have seen on this subject.

His Lordship said to me, with reference to the field I have spoken of, "Now I will show you how we obtain these results;" and he sent for a 4-horse plough, and showed me a single furrow 16 inches deep, turning over a mass of earth without one clod in it of the size of one's thumb, so that every particle was brought into contact with the air in that single ploughing.

Mr.——— tells us that the Marquis had sunk a capital of £13 per acre in the improvement of this field, leaving a permanent charge, at 4 per cent., of 10s. per annum, equal to 1½ bushels of wheat with the straw.

While on this visit I asked the Marquis to show me a famous clod-crushing roller that he had invented, but he said, " I have learnt better than that now. Such a machine only proves bad farming. *There is no such thing as a clod on land that's well farmed.*" This is the vital principle of farming. The air must have access to every particle of the soil.

Now, I ask, how is it that this book, written by the greatest agriculturist in Scotland, is never referred to, while what is written by men who have totally failed in accomplishing anything in this matter is continually quoted as the height of wisdom?

These results of the Marquis' experiments are alone quite conclusive of the main point of the question. They show with certainty that agriculture is like everything else, capable of improvement, if results were really necessary to satisfy us of what is surely a matter of common sense.

I may add here that the book, " Yester Deep Cultivation," shows also that this farming was highly profitable, that is, that produce was obtained at a much lower cost than by the old methods, even by the best farmers in the world, and I have good reasons to believe that the property of the Marquis was greatly increased by his operations.

I may now come to my own experiments. My life has been passed in India, almost entirely in civil engineering, chiefly in works of irrigation and internal navigation, which fully occupied me for forty-five years, so that it was not till I was old and greatly worn out by Indian hard work and sicknesses, that I began to make trifling experiments in cultivation in different gardens belonging to the houses I occupied for short periods. I had no property, and therefore could not fully carry out such experiments, and I had not the least idea of the results that were attainable. It was clear enough that there was something quite wrong about the whole state of farming, and I felt quite sure that what the Marquis of Tweeddale had accomplished was sufficient to prove that a radical change was required in the whole farming ideas of the nation, but it was only by slow degrees that I realized the unbounded prospect that lies before us.

I can't be surprised that others are slow to take in such new ideas, so utterly contrary to those universally entertained, viz., that the present amount of produce is the ultimatum of which the earth is capable. I was, indeed, greatly astonished many years ago when I dug up an average of 14 lb. of potatoes per root, planted 3 feet apart each way in a very rich sandy soil at Tunbridge Wells, equal to 30 tons per acre, and this the first year of aerating the subsoil, but I had not at that time given much thought to the subject, and did not consider what amazing conclusions this pointed to. The same when, in this poor soil of my present garden, I saw 190 ears

on a single plant of wheat, and these 7 and 8 inches long, with about 8,000 grains grown from one, it did not lead me to think much of the extraordinary contradiction it implied to all the present ideas on the subject. Nor when I sent examples by an experienced farmer to the Guilford Exhibition, and he told me that all he showed them to agreed that there was not a sample there from the best soils in the county that would compare with them, and when I showed one of them to an old miller, and he said he had never seen such a sample in his life, did even these proofs as to quality much impress upon me the strange prospects that they opened up.

It was only by degrees, and after being led to read the things that are written invariably by agriculturists, that I began to realise, as I have said, that they knew nothing upon earth about cultivation.

I have now for several years tried to improve the cultivation of several of the main farm products, and the results have been the same, with corn, potatoes, roots, grass, as well as with strawberries, and they have continued to increase to the present time. There is certainly in this garden every year not less than five times what it produced when I began. There is adjoining land of still poorer quality, such as would probably produce 20 bushels of wheat under average present farming. I got permission from the owner of this to break up one-eighth of an acre, that I might have a complete experiment of hitherto uncultivated land, and get an idea of the time it might take to aerate it in some good degree to 3 feet deep, and what it might cost with a certain kind of subsoil. It is a poor, silicious soil, without any lime in it, but with some stones. It had to be broken up with the pick, and the first operation cost about 6s. a rod, or £50 an acre, a man breaking up half a rod a day. The first two years I did not mix up the subsoil with the upper few inches, but I think in the third year I mixed it well, and the result is unquestionable, though I don't feel sure that it would not have been better to have kept the subsoil in its place a year or two longer. After the first breaking with the pick, I dug it with a 16-inch fork, taking care to break the clods in some good measure, without any additional material to bring the soil into a more friable state, so that it is still far from such a state of tilth as I am convinced every soil in the land ought to be reduced to, that is, to the state of absolute sand like the vale of Evesham, in Worcester, so that an immense surface may be brought into contact with the air, a thousand times as great as is exposed to the air in the ordinary system of turning over a solid slab of earth.

This second digging to about 3 feet deep costs about £25 per acre with hand labour, and I think it would be worth while to repeat it every year in a garden. In a farm, of course, it would be a question how to turn it to this depth, whether by steam digging or by following ploughs. Lord Tweeddale ploughed 16 inches deep in one furrow with four horses, and I don't know why a greater depth than this should not be turned in a single furrow.

I may now give some account of the results here in the past year.

From what I have seen, both in my own garden and in the farms around, I conclude that this has been one of the worst years for farm produce ever known in England, and the late reports in the *Times* support this. Indeed, I have seen this year the worst case of blight in a field of wheat that I ever knew.

It has indeed been an extraordinary year; an extremely trying winter, an extraordinary spring drought, and a cold burst in July, at the most critical time of most of the wheat crops, that is, just when the grain is beginning to form, though some fields that were later in a great measure escaped this.

Its effect on the wheat here was most extraordinary—in the early kinds destroying two-thirds of the grain, and in the later one-third.*

Upon the whole the hay harvest in the country seems to have been about half the average, and the wheat about three-quarters.

The best of my kinds of wheat—an improved rough chaff, planted 1¼ feet apart each way, 30,000 plants per acre, averaged fifty-five ears per plant, with 3 oz. of grain of fair quality—perhaps 63 lb. per bushel. I sow in spots 1½ or 1¼ feet apart each way, four grains in a spot, an inch or two apart, and as soon as they are a few inches eigh I pull up three, leaving the strongest one. Thus an acre requires either 80,000 or 120,000 seeds, 8 or 12 lb. of corn, and 20,000 or 30,000 plants are left. One great want is thoroughly-selected seed, grown at any cost, as cattle and horses are bred by careful selection. Mr. Hallett, of Brighton, has done great good in this way, but it requires to be much more systematically carried out.

This gives 90 bushels per acre, with 6½ tons of straw, 6 feet high, which, at 4s. 6d. a bushel, and £3 per ton, would sell for £40 per acre on this poor soil, and in a year of 25 per cent. below the average, equal to £53 in an average year on this land, and to £63 on average wheat land. I allow 4s. 6d. a bushel on account of superior quality which such cultivation brings.

Now the value of the crop on average land would be 30 bushels at 4s., and 1¼ tons of straw at £2 10s., or £9, one-seventh of the above. As to the superior quality of the straw, the Duke of Rutland wrote to me that straw grown by allotment holders near him fetched 30 per cent. above the general market price from its quality, agreeing with the results I have found in respect of corn.

This year also a plot of early potatoes, planted 2 feet by 1 foot, averaged 2 lb. per root, equal to 20 tons per acre, which at £5 a ton for early potatoes would be £100 per acre. But this was above an average year for potatoes.

Again, a plot of spring-sown rye grass produced in three cuttings at the rate of 4½ tons per acre (in this extremely bad hay year, about 50 per cent. under average), and certainly of very superior quality. Had this been sown in the autumn I think there would have been 8 tons this year.

I also grew two or three kinds of Indian corn. One kind was 8 feet high. These crops agree entirely with all my former years, and there can be no possible mistake about this prodigious produce as compared with the ordinary crops. These are facts; it's impossible to get rid of them. What are we to say to model farms that show no improvement of any consequence in a long series of years.

Let us try to discover how it is that nothing has yet been done in the way of improvement worth mentioning.

I have a book giving a very circumstantial account of systematic cultivation on a large farm for a series of years, by a gentleman of intelligence and energy certainly far above the average. Now, in this book not a word is said about the depth of ploughing, the number of ploughings, or the state of the soil in respect of its disintegration, the things upon which all depends. It's like the expedition to Khartoum by human labour, without the use of steam, averaging 3 miles a day, when one 2-foot steamer would have carried a power equal to the whole power of the men employed.

What would be the state of Atlantic navigation this day if every company had acted upon the principle that no other means but sails could be used? And so in every other art and science. If men had begun with begging the

* And all this followed by a very unfavourable harvest-time.

question, and had continued to work on the principle that no new means were to be used, because no real improvement was possible, what would be the present cost and quality of every article, steel for instance?

What then is the main point in this improved cultivation? *It is simply giving more air to the soil.* One leading agriculturist stated that of the whole weight taken from the land in the way of produce, 95 per cent. comes from the air, thus curiously agreeing with my conclusion from practice.

If I ask a farmer why he ploughs his land some 5 inches deep, he is astonished at my ignorance, but answers, "to open the soil to the air." If, then, I ask him why he gives only so much air, why he does not expose it more thoroughly to the air and that to a greater depth, he has nothing to say. Has he ever tried in the same field, part thus partially aerated, and part more thoroughly; he has never made this simple trial. What it will cost to give more air to the soil, and what will be the value of the increase of the crop consequent, he does not know. This is the general state of things. I have lately seen a letter which states that the subsoil is in such a state that nothing will grow in it if it is brought to the surface, and therefore that it must never be broken up. Could there possibly be a more complete specimen of false arguing? The upper soil is good and productive, the subsoil is in a poisonous state. This is quite true. What makes the difference? The upper soil has become in a measure aerated, and the subsoil has not, and the conclusion is that the subsoil ought not to be aerated.

Could there be a more palpably false conclusion? The writer of the letter says, "If it is brought to the top." But who would think of substituting this poisonous subsoil for the aerated upper soil which is productive?

Surely the true argument is, if the air makes all this difference, certainly the thing to be done is to aerate the subsoil also, but not to bring it to mix with the surface soil till it is in a measure aerated. In this garden the whole 3 feet of depth is now mixed up, and the amazing crops are the result. I am not sure that I allowed sufficient time for this aeration of the subsoil before I mixed up the whole depth, but if it was done too soon, it is in spite of this mistake that these crops have been obtained, and a further increase must be gained as the aeration is more perfected by repeated operations, and, indeed, the crops seem to me to have gone on improving up to this time. But how far this aeration of the raw soil may be hastened is a great point to be investigated; for it must be remembered that this aeration has only been tried by one individual for a few years. What may be effected when a multitude of experienced, intelligent, and energetic men are roused out of their strange torpor, and set themselves to the work of improvement, as is the case in every other profession, is beyond all present calculation. I am myself quite certain that as great a change may be effected in cultivation in respect of all the three—quantity, quality, and cost—as has been in all other arts. If instead of this poor soil, rather light, an experiment were made, for instance, on the grand, rich, stiff clay of the Vale of White Horse, in Berkshire, who can estimate what results would be obtained? This soil in the present state is almost impracticable, yet it produces great crops and of the very best quality. There are only a few days in the year in which anything can be done in it. When dry no plough can penetrate it, and when very wet no horse can walk on it. But if this splendid material were brought into a practicable state, broken up 3 feet deep, and reduced by means of burnt earth and other ways to a friable condition, it is impossible to estimate what it could produce. It would, perhaps, cost £200 or more in the first instance to bring it into a thoroughly practicable state, involving a permanent charge of £3 per annum, or the value of 20 bushels of wheat with its straw, but I

doubt whether a better investment of money could be made in any part of the world. What is wanted especially is this applying capital and intelligence to the best soils in the country, those that will admit of the greatest improvement in respect of quantity, quality, and cost. We have, indeed, had a few energetic men who had some idea of applying capital to land, but they have most strangely applied it to the worst.

One great landowner expended £100,000 on 2,000 acres of the worst land on his estate, and it returned 2 per cent. What can lead men of intelligence to such false conclusions. If this money had been applied to the best land on his estate it would have certainly returned 10 or 20 per cent., even if not very intelligently expended. So men are continually talking of improving the bogs of Ireland. Do men judge thus when they are going to invest in mines? Do they search for the poorest deposit of ore they can find?

I may here also refer to another strange mistake that is made in calculating the results of capital invested in land, that is, confounding the money expended in permanent improvements with current expenses. Of course no right conclusions can be reached if this is done. The great fact of the small increase of produce that is required to meet the interest of a large sum permanently sunk in land is thus continually lost sight of. A hundred pounds is a large sum to expend on improving most acres of land, but it requires, at 4 per cent., only 10 bushels of wheat with its straw at present prices to pay this interest, even supposing that the future current expenses of cultivation also are not reduced by the improved state of the land. How few acres there are that would not be raised from 40 bushels to 50 by an expenditure of £100 in permanent improvements.

My own conclusion, from what I have seen, is that there is hardly anything in the world on which capital is expended which makes as large a return as this land under our feet would yield.

I must acknowledge that I have not materials with which to make anything like a real estimate of the probable cost and return of such improvements as I propose on a farm, but I may here be allowed to state what I suppose they might be, so far as my consideration of the subject goes. Let us take a farm of good land with a practicable subsoil, yielding now 40 bushels of wheat.

	£	s.	d.
Interest on cost of £50 at 3 per cent.	1	10	0
Interest on £100, breaking up by hand, &c., 3 feet deep, at 4 per cent....	4	0	0
Interest of working capital, at £30 per acre, 4 per cent.	1	5	0
Local charges	1	0	0
Three ploughings, with two ploughs of four and six horses, at 5s. per horse	7	10	0
Other cultivation and harvest expenses...	3	0	0
Manure, 30 tons at 7s.	10	10	0
Total	£28	15	0

RETURNS.

	£	s.	d.
150 bushels wheat, at 4s. 6d.	34	0	0
10 tons straw, at £2	20	0	0
	54	0	0
Expenses	29	0	0
Profit	£25	0	0

besides interest of capital. This allows 30 tons of stable manure every year, six times the present usual rate.

AGAIN, WITH RYE GRASS.

	£	s.	d.
First year as above	29	0	0
SECOND YEAR.			
Interest, &c., as above	7	0	0
Current expenses	5	0	0
Total of two years ...	£41	0	0
RETURNS.			
First year, 10 tons of hay at £5...	50	0	0
Second year, 12 tons	60	0	0
	110	0	0
Expenses	41	0	0
	£69	0	0
Profit per annum besides interest	£34	0	0

These are the results that I fully expect from what I have seen every year for several years on this poor land.

I may mention that with respect to manure, though I am quite clear that it is absolutely necessary, I have greatly modified my ideas about it of late. I judge that, at first, I greatly over manured, and I thought it necessary to stop it altogether for a year or two. At first, for one year, I gave 100 tons per acre, but this was applied throughout to the depth of 3 feet, and was only equal to 14 tons for the usual 5 inches, for which about 20 tons are usually given at one time. I rather thought that too much could not be given, but I am now satisfied that this is quite a mistake, and that the ears or roots may be greatly injured by it. I was looking at a highly cultivated farm in Scotland, of rich land, which the farmer was steam-ploughing a foot deep, and I said to him, you are giving the land a heavy dressing, when he replied, "70 tons to the acre; I gave another field 120 tons"—of rich city stable manure. But this, I am now sure, was a mistake, though I am also convinced that this point also is one that requires to be investigated as it has not yet been. It is also a question with me whether what is given should be all applied to the upper soil only, or mixed throughout.

By the above estimates it will be seen that I think that produce can be obtained at half of the present prices or less. And it must be remembered that I have been very far from seeing the system fully carried to its possible conclusions. My land is yet very far from being reduced to a state of absolute sand, like the vale of Evesham, which is certainly advisable in order to expose the greatest possible surface to the air. In connection with this I should call attention to the remarkable fact that in the case of the sandy soil at Tunbridge Wells, I mixed up the whole depth of 3 feet of soil the first year, and yet obtained the surprising results before mentioned.

I must now add some general remarks. Though England has made no progress in this century, yet there is in the world a great range in the degree of cultivation. In the West of Ireland, and in the great mass of small holdings in France, the average value of produce is about £4. In England

it is about £8. In Scotland there are whole counties in which the average is £14, in spite of its very inferior climate; in many highly cultivated farms there £18; on one near Edinburgh I made out that it was at least £20.

Now what are the effects of such better cultivation? As we advance from £4 to £20, do we find the owners, the tenants, and the labourers poorer or richer? There can be no possible question about this. Just in proportion as the cultivation is higher, such is the condition of all classes connected with the land. I went into the labourers' cottages on the estate of Lord Tweeddale. Any gentleman could have lived in them in perfect comfort, if he would be content with deal instead of mahogany, and so on. If this is the case up to the point at which cultivation has already been improved, what should prevent its continuing up to any further point attained? Wheat is grown cheaper in Scotland than it is in France, in spite of the inferior climate. Why should we imagine that with further improvement in cultivation it will not be grown more cheaply still, and especially when we consider that the main point of all, viz., that the air is the chief agent of production, is not understood by any of these.

I am greatly encouraged in respect of this matter by two facts I have lately heard. One is that a man has grown 42 tons of potatoes on an acre; the other is that at Cawnpore, in India, 48 bushels of five month wheat have been grown on an acre, where the usual produce on river irrigated land is about 10 bushels. From these I learn that there are obscure individuals who are not misled by great agriculturists who tell us that they have failed to make any improvement, and therefore that nobody else can. The mischief that these false leaders do is incalculable. One of them indeed tells us that he has made experiments, but, strange to say, they were to show how little could be produced by still worse cultivation, that is, by withholding the one acknowledged necessary agent—manure—for a series of years. By this means he succeeded in reducing the produce from 45 bushels to 12. But this is not what we want to know. The question is not how little can be produced, but how much, and how good, and how cheaply.

I have a long letter from one of these leaders, the main argument of which is that he has been for many years in charge of a model farm and has made no improvement, and therefore, of course, all my facts go for nothing, and it is impossible that any obscure individual like myself can do anything in this way. One of the very first things therefore is to get the people to throw off these false leaders, and to inquire for those, however, insignificant they may be, who show by actual results obtained that they have some knowledge of the first principles of cultivation.

I am also encouraged by the fact that in consequence of an admirable manly article in one of the leading papers, there have lately been a good many applications for copies of my pamphlet on this subject, almost all, of course, from persons of no consequence, for it cannot be expected yet that great men will condescend to hear what is said by men of whom nobody ever heard. The question, as usual, is not what is said, but who has said it; not what is done, but who did it; never mind whether it is how much has produce been increased or how much diminished, but who increased it or who diminished it?

What I do insist upon is that an increase of seven-fold by the most obscure individual is a matter of more importance than a decrease of five-fold by the greatest man in the profession.

He who can tell me how to grow two blades of grass where one grew before, without double expenditure, is the man wanted, whoever he may be.

Another thing I urge is that any person can make experiments on soil. It requires no capital, no talent, no learning. A flower-pot of earth, a square yard, a rod, an acre, a farm, may be the extent of useful effective trial. And, further, no Act of Parliament, no formation of companies, no agreement of our neighbours is required for this. Every man, from a duke to an allotment holder, can set about these improvements at once, without hindrance, according to his circumstances, whether rich or poor. This is a great thought, that every individual may at once set about this work. It has none of the hindrances of railways, or other great undertakings; it requires no long series of years to bring it into general operation. And as to capital to carry it out on any considerable scale, the present want is not that of capital, but of employment for it. There are hundreds of millions unemployed, and there are companies now in existence which exist for the very purpose of supplying capital to any person and on any scale, however small. Hundreds of millions have been supplied by Englishmen to foreigners under the vilest governments, and they have had so many losses in consequence, that capital to be employed in this glorious land, under our own flag, and within reach of inspection, is available for such a purpose to any extent.

But, further, what is involved in this question? Does it extend to any of the leading interests of the present time? It involves:—

(1.) The return of the population from the towns to the land.
(2.) The employment of every man of the present multitude of the unemployed.
(3.) The investment of any amount of the vast capital lying idle.
(4.) The relieving the country from absolute dependence upon foreign, distant, and more or less inimical countries for necessary food for man and beast.
(5.) The bringing back of landowners to residence among their people.
(6.) The providing abundantly for all classes employed on the land, owners, tenants, and labourers.
(7.) The great improvement of the quality of food, both for man and beast.
(8.) The lowering of the cost of all the necessaries of life, and consequently of all our manufactures, giving us an enormous lift in our competition with the foreigner.

Are these not all great and vital questions, especially in the present state of things?

It is said, if we do improve our agriculture, others will follow us. First, is not this the case with everything? Do men give up all idea of improvement in other arts for fear others may learn from them? But, secondly, this move would be in the very direction in which we have the special advantage—that is, in the amount of labour. In America, Australia, &c., the difficulty is about labour, the very thing in which we abound.

Now, in place of present reports of progress in fifty years, let us not rest, though it take five or ten years, till we have to say, instead of 40 we now grow 150 bushels of wheat; instead of a weight of 60 lb. per bushel we have now 70 lb.; instead of $1\frac{1}{2}$ tons of straw we grow 10 tons; instead of millers and bakers pleading that so inferior is the English wheat that they can only use it by mixing it with foreign, we challenge the whole world, in this as in everything else, to exhibit such superior wheat as we produce; instead of wheat costing 4s. a bushel to grow, we produce it at a cost of 2s.; instead of unfavourable seasons bringing the produce down to 25 per cent.

below the average, our lowest is 5 per cent. below; instead of agriculture being the only thing that makes no progress, we can show that we beat every other art in the land in the change we have effected; instead of taking for our leaders those who have done nothing, we accept only those who show us how to emerge from the slough of despond, whoever they may be.

I would now only urge that this subject is curiously appropriate for the Balloon Society to take up. It is one question of their own especial element. Hitherto they have been occupied with that portion of the air which is above the earth; what is now brought before them is that portion which is, or ought to be, under the surface of the earth.

May they be successful beyond all their thoughts in both departments, so far as shall be compatible with the purposes of Him whose thoughts are above our thoughts, as the heavens are above the earth. One thing is certain, that it is proved that the capacity of the world to yield her increase is altogether beyond what has been universally supposed.

One thing I would suggest and earnestly recommend, because it could at once be everywhere done, and I am fully persuaded it would be of extensive effect, and that immediately.

It is that on all lands, excepting those which are of perfect sand, a plough of twelve shares, in four rows of three each, should be substituted for the present plough. The first row would be 3 inches long and each of the others 3 inches more; the breadth to be 9 inches.

If the land has been hitherto ploughed 5 inches deep, I think this implement might at first be used to 9 inches deep, mixing 4 new inches with the old upper soil, but I would repeat this ploughing four times the first year, at intervals of two or three weeks, using it only when the soil was in such a state of moisture as to facilitate its granulation. In this way I think the soil might be considerably aerated to 9 inches the first year; the second year I would plough to the full depth of 12 inches.

By this means there would be at once some approach to the breaking up of the soil, whether light or heavy, as there could not be clods of more than 2 or 3 inches diameter.

Such a change would only involve the cost of a new plough, and it might at once be introduced on every farm, large or small. The present plough, as it is used on lands not before brought by other means to a proper state of tilth, leaving great clods, is a complete mistake.

The Silk Industry.

HE Department of Agriculture in directing exhibits of silkworms to be epared was actuated by more than ordinary design and motive. For any years desultory efforts have from time to time been made by private rsons of all ages and conditions of life, from mere boy and girlhood to en of great practical experience, as well as of acknowledged skill in rearing kworms in countries outside Australia, who sought to establish the industry d make it profitable here in Australia. Even the best qualified and most peful all failed, and failed generally from one chief but fatal cause, namely, e insufficiency of the supply of mulberry leaf, the indispensable food for e silkworms.

The discredit that so long overshadowed the exertions of several ladies d gentlemen during late years, though amply justifying and worthy of re generous appreciation, has now given way to more hopeful considera- n—and the evidence is now abundant that the whole subject is ripe for a ional and sustained effort to bring into being a substantial silk industry l create an additional spring or incentive to productive energy and ployment for much hitherto unused or unprofitable labour. The Govern- nt has undertaken to afford some preliminary or elementary instruction, l by instruction and example assist for a while to help beginners to learn thods of rearing silkworms for *profit*.

For a long while it has been known that a local expert had invented and ried through successfully year after year a plan or system quite novel l unique in its character and unknown elsewhere. It is true that, though ome sense there was no secret about it, and the fact open to view at any e by any person who chose to see, yet it was at a private gentleman's ablishment, and further, the fact was patent that no other person had n able to master the process.

Thus the premises being the already well-ascertained facts—

1st. The well-proved and acknowledged suitability of the climate and natural conditions for commercial production of cocoons in New South Wales.

2nd. The existence of mulberry trees of all the most useful varieties and of mulberry silkworms of the best kinds already acclimatised in the Colony.

3rd. The material advantage, unknown elsewhere, of the power of using the strictly annual silkworm as stock to be reared at any period of the year desired, wherever, and whenever, there may be mulberry-leaf available in sufficient quantity to feed the worms.

Government was induced to arrange for the instruction of a limited nber of persons of both sexes in the most approved and economical thods of rearing silkworms, and for the propagation and treatment of lberry trees.

The following brief note appeared in the official catalogue of the In
and Colonial Exhibition, London, 1886 :—

[Extracts from Reports, Colonial Sections, Colonial and Indian Exhibition, Lo
1886.]

COCOONS.

Species of cocoon, name and address of producer and exhibitor.—Mulberry-fed silk
cocoon (*Bombyx Mori*). Produced by Charles Anthony Brady, Tumbulgum, T
River, New South Wales, and exhibited by him in the New South Wales Court,
51, No. 332.

Description of cocoon.—*Form*—Elliptical oblong, with slight medial depression.
Colour—Creamy white inside and outside.
Texture—Fairly compact.
Reeling—Good.

Description of the bave of cocoons.—The reelable cocoon thread or bave is compo
two cylindrical fibres or brins, consisting of homogeneous matter (*fibrol*, Schorle
surrounded and cemented together by a substance resembling gelatine (*sericin*, o
gelatin, Schorlemmer). This latter is called "gum" in England, and "*grès*" in F
As with other mulberry silks, the two brins polarize light very beautifully wh
bave is examined with the microscope and polariscope, but the surrounding silk ge
which forms about 33 per cent. of the total weight of the bave, has no polarizing p

Weight of cocoon.—0·634 grammes.

Dimensions of cocoon.—32 x 16 millimetres.

Length of bave reeled.—554 metres.

Weight of bave reeled.—0·159 grammes.

Fibre of bave, milligrammes per 500 metres.—144 milligrammes.

Fibre of bave in deniers.—2·70.

Mean diameter of bave.—0·0328 millimetres.

Mean elasticity of bave.—18·1 per cent.

Mean tenacity or strength of bave.—6·7 grammes.

Percentage of silk reeled from the cocoon.—25·08 per cent.

Diameter, elasticity, and tenacity of the bave :—

1. 10 metres from the end at the outside of the cocoon.
2. " " at the middle of the cocoon.
3. " " at the inside of the cocoon.

	(1)	(2)	
Diameter of bave in ten-thousandths of a millimetre...	345	345	2
Percentage of elasticity, average of six estimates ...	16·7	22·8	1
Tenacity or breaking strength in grammes, average of six estimations...	7·7	8·5	

Weight in milligrammes of each 100 metres of bave reeled from the cocoon
mencing at the end of the bave which is at the outside of the cocoon :—

(1)	(2)	(3)	(4)	(5)	(6)
41	37	33	28	15	54 metres remained, we 5 milligrammes.

The cocoons were ordinary buff-colored, partially sun-dried, but not prepared
wise.

Mr. Brady, in a printed circular, states that the climate on the Tweed River fur
the mulberry-tree in great abundance, yielding daily supplies of the leaf from the
July until April. The soil, he says, is very fertile, the rainy season being from Ja
to April, and followed by a dry winter.

He states that he has, for many consecutive years, aided by the power of the c
and country, managed to obtain a continuous hatching of silkworms day by day or
by week, or, in his own words, "Assuming that the management of the eggs ha
duly attended to at the proper time . . . . the continuous hatchings will p

NOTE.—Metre = 39·37 inches. $\frac{1}{10000}$ millimetre = 0·000003937 inch English. 100 inches of b
quality indicated would stretch or extend before breaking to 118·1 inches. 1 gramme = 0·03527
English. The diameter and strength of the bave or natural pair of fibres are of course (?) double t
the single fibre or brin.

the strange phenomenon peculiar to New South Wales, of living silkworms in every daily or periodical stage of progression up to cocooning (every day's lot must be kept severely separate)—that is, worms of every stage and daily growth, and through every moult and change of forms (metamorphosis) contemporaneously, and at the same time the emerging and coupling of the moths and deposit of the eggs (the graine again). This continues till operations for the season are finally closed, when the staff employed can respite for a winter, during which refit and preparations are made for the following season.

"The whole of the natural history of the mulberry silkworm, absolutely unchanged in its natural annual habit, is in view at one and the same moment—worms hatched on the day itself, and of every other day, from one day old to full grown ones, actually making their cocoons, the moths emerging, and new eggs being produced, which are a generation to proceed with in a subsequent season. Arranged beforehand, and in the hands of a skilled person, the process is as much under control as the machinery in a factory. It is animated, self-reproducing machinery, maintained by supplies of the silkworms' only natural food—the mulberry leaf."

Many persons viewing the Silkworm Exhibits at the Agricultural Show in Moore Park, appeared to be impressed with the changed aspect of this valuable industry presented to their minds on that occasion,—hitherto neglected here, while largely adding to the wealth and comfort of great bodies of people—producers of the raw material for silk in Europe and in Asia. Casting off the silly fancies and childish toying which have so long pervaded the Australian mind in regard to the silkworm insect, some few at least of the visitors who thronged around the tables early and late, demanding attention and explanations, made it evident that they were desirous of useful information, and to learn more than could be learned in the short time the exhibition would be open. In short, to be instructed about an occupation which offers the inducement of profit to almost any one employing him or herself therein.

The annual aggregate value of the cocoons (sold in the state just as made by the silkworm caterpillar without any winding or reeling or any other preparation) raised in Italy and France is from about five millions to six and a half millions of pounds sterling (£5,000,000 to £6,500,000) for each of those countries. This affords an average return to each individual rearer of about £9 or £10 in France, £10 or £11 in Italy, while in regions bordering the Eastern Mediterranean Sea the average reward to each rearer appears to be from £10 to £12. In every case the whole time occupied is the same, namely, about six or seven weeks per annum.

If the cocoons are not sold immediately, or are intended to be kept, they must be dried so as to destroy the life of the grub or chrysalis inside, or (preferably) dessicated, that is, so dried that not only is the life within put an end to and the boring out of the cocoon by the moth avoided, but the insect itself reduced to dust so dry that when crushed by pressure the cocoon shall not be soiled nor injured. When thus treated they can be kept for an indefinite period, and, packed in bales, travel to any part of the world.

Inexact and sometimes extravagant statements having appeared in unauthorised publications we now mention for general information and to prevent unreasonable expectations, that the open market value of cocoons all round is about from 9½d. to 12d. or 13d. per pound weight, according to quality, in the condition just as completed by the worm. If dried (and of course in proportion to the degree to which drying or dessication is carried) the market value will be greater, and double or several times more than in the "green" state. In short, as the cocoon becomes lighter by reduction of the weight of the moisture, &c., belonging to the grub, the proportion of the valuable matter, the silk, is greater. It is, however, very generally found most convenient as well as most profitable for the rearer to sell immediately, that is, as soon as the cocoons are fit to be taken from the "bush"—leaving

the dealers (factors, but most generally the "Filandas" and reeling mill proprietors) who employ many hundreds of workpeople all the year round, and have special facilities for wholesale drying, storing, &c., of the fresh cocoons, or to reel them at once as far as may be practicable.

The value of mulberry leaf to the grower (the "plantation" value) may be roughly estimated at about £3 or £4 per acre so soon as ready for use, increasing with age to £7 or £8 and upwards.

By local experience it is known the produce of one acre of mulberry property grown and fed to silkworms will realise by sale of the cocoons from £15 to £25, and still more if skilfully and economically used.

The Exhibits.

Although somewhat premature, arrangements being far from complete at Booral, opportunity was taken of the Agricultural Society's show in Moore Park for displaying some of the living silkworms raised at the Government Silk Station—thus beginning in part a demonstration of the capability of the Colony for raising cocoons at almost any time of the year—in fact whenever and wherever mulberry leaf is available for feeding the worms.

Upon requisition the Officer-in-charge forwarded a collection for this exhibition, consisting of a daily succession of silkworms (in separate lots) hatched on the days of exhibition as well as on many previous days, showing a lot of every day's growth, and through every-daily stage to full-grown; mature caterpillars daily "mounting" the "bush," each day its separate appropriate lot then due, and actually making their cocoons; also moths emerging from cocoons every day, and finally accomplishing their life round of existence by each day's moths laying fresh eggs. There was displayed the whole process and life history of the mulberry silkworm insect in all stages at once, at the same place, all different, yet contemporaneous.

It is true similar demonstrations have been witnessed in this Colony for years, but the scene of operations formerly of that novel and till then unexampled process being at private establishments, the evidence failed to gain adequate attention from the general public, though many leading citizens recognised its value and prospective importance. Hence the present action of the Department of Agriculture, with a view to institute a better understanding not only of the benefit that would accrue to an intelligent public by much enlarged fields of profitable work, but also to demonstrate the immensely extended scope arising from our capabilities here of cheaper production, economy of labour and material, by frequent repetitions of rearings, the same "plant" and utensils, &c., serving again and again, using up much good mulberry leaf hitherto wasted but which can now be converted into silk.

The exhibits were taken in hand by Mr. George Valder, who had passed a short time at Booral for a little preparation. Mr. Valder's report is as follows:—

"I left Booral on 9th March with exhibits of silkworms for the Royal Agricultural Society's show, consisting of 30 trays of silkworms of various ages, from 1 to 30 days, each day being represented by one tray, and a card of eggs. The worms were all reared at the Government Silk Station, Booral, from eggs obtained from Italy and the card of eggs was from Japan. The Italian worms were stated to be of the Gransosso, Novi Ligure, Fossombrone, and other races.

"The show took place on 21st, 22nd, 23rd, 24th, and 26th March. By this time the older worms brought from Booral were spinning and supplemented

by others hatched out daily. I was enabled to exhibit worms all through from hatching out, daily also, until ready to spin (make their cocoons). Then with help of numbers of worms and cocoons received on the morning of the show from Booral, I exhibited a large number climbing into bushes placed for them and making their cocoons. Moths also at same time were viewed as they emerged day after day from the older cocoons and proceeded to lay their eggs. Thus completing an exhibition showing at one view every stage in the life history of the mulberry silkworm, from the time of its birth, just hatched, come out of its shell (the egg) to the mother moth again, laying the eggs for a future year. Such a complete exhibit of silkworms as this had certainly never before been seen at any public show, nor in any other part of the world.

"A remarkable feature about these exhibits was that, notwithstanding the extraordinary disadvantages and vicissitudes to which the worms were exposed, such as heat (as high as 88° Fah., and probably more), cold (as low as 53°), sudden changes in temperature, foul air, dust, travelling packed closely in cases, &c., &c., they went on working day and night without the slightest apparent injury, thus proving how wonderfully healthy and strong worms properly reared in this Colony are. Several Italian and French gentlemen, who had had extensive experience of silk culture in Europe, said they could not understand how the worms could be so vigorous and healthy, for in their own countries they had to take great precautions to prevent sudden changes in temperature, exposure to draughts, &c., or the whole of their stock would be carried off.

"A general opinion freely expressed by people who professed to understand about silkworms was that the labour required to manage a large number would be too costly to allow of any profit, but on questioning them I found their ideas and 'experience' were gained by keeping a few dozen or a few hundred worms in very primitive style. On my explaining and showing how easily a few hundred thousand could be fed and managed their eyes were opened. Many people told me they had learned more in five or ten minutes' chat with me and seeing the worms than they could gather from books in as many months.

"A number of Bathurst gentlemen who were present strongly urged that the Department of Agriculture should send the exhibit to the Show to be held in that city on 11th, 12th, 13th April. The Department complying with their request, I accordingly left on the 9th, taking an exhibit similar to that shown in Sydney, with the addition of two fine samples of silk which had been 'grown and reeled' at New Italy. The whole of the insects, to the great astonishment of the spectators, had travelled during the day and night about 280 miles from Booral, and arrived in perfect condition. As was the case in Sydney, the worms proved one of the greatest attractions. Mr. Williams, local Secretary to the Women's Silk-growing Association, and an enthusiast, gave me every assistance, working hard, and relieving me greatly in a portion of my duties, which here, as also in Sydney, required constant attention early as well as late.

"The next occasion at which the Government silkworms were exhibited was at the Chrysanthemum Show of the United Horticultural Societies, in the Town Hall, Sydney, on 19th, 20th, 21st April. The exhibits were similar to those at Bathurst, and the worms recently from Booral again travelled, without loss or injury, to Sydney. What an attraction the worms were, and the interest they aroused on the subject of silk-growing, was very pronounced. The Government House party, including Miss Ottmann, warmly praised the show, the latter lady expressing her opinion that similar

exhibits would be very useful at schools and colleges. A number of chi
from the Deaf and Dumb Asylum were admitted free to this show. Th
the display of flowers was an exceptionally fine one, no sooner did
discover the worms than the flowers were entirely neglected. This inc
caused a good many conjectures as to whether it would not be well to
these children how to grow silk.

"At each show numbers of people congratulated me on having s
splendid exhibit, as also did several foreigners resident in the countr
others in town who had had experience, and were familiar with th
industry in their own countries. They considered the demonstration
novel, interesting, most telling, and instructive. So attractive on
occasion did the worms prove the stalls were nearly all day simply cra
with people eager for explanations, while many had to go away wi
being able to get near enough to see or hear."

Conclusion.

It must be well understood that the Government has no intention t
students for learning. All that is contemplated is rather to lead the
of private persons to exercise their own wits and exert their own en
for their own advantage, and only so far move in the case of the s
growing silk as to endeavour to save beginners from mistakes, and
them as much as possible from expense of failure in a pursuit new t
Colony, and to leave enterprise in this, as in every other direction,
own natural development.

On the Choice and Use of Artificial Manures.

(continued.)

F. B. GUTHRIE,
Departmental Chemist.

Manures Containing Nitrogen.

NITROGENOUS manures fall under three heads, according as the nitrogen hey contain is combined with organic matter or exists in the form of mmonium compounds, or of nitrates. In the two latter forms it is soluble n water, and immediately available as plant-food. Most of the quick-acting oncentrated fertilizers contain one or other of these compounds, usually ulphate of ammonia or nitrate of soda, and sometimes nitrate of potash. What is known as organic nitrogen is contained in animal products, refuse, nd excreta, such as blood, bones, hair, meat, guano, farmyard manure, &c.

The nitrogen in these products is not in a state in which it can be mmediately utilised by the plant, but requires first to undergo a fermentaion within the soil, resulting in the first instance in the formation of mmonium compounds before it is available as plant-food. Now, although he nitrogen in these different substances is usually classified for the sake of onvenience under the one heading of "organic" nitrogen, it occurs therein n a variety of combinations, some of which are more susceptible to fernentation than others, and consequently more rapid in their action. The mell of ammonia is soon noticeable from such products as urine and farmard manure, which contain a large proportion of their nitrogen in the form f urea, whereas hair, wool, &c., resist decomposition for a considerable ength of time.

The following list shows the order of solubility of the most commonly ccurring of these products, the most soluble standing at the head :—

Fresh urine.	Fish-scrap.
Dried blood.	Dried offal.
Dried and pounded flesh.	Coarse bone-meal.
Guano.	Horn-meal.
Fine bone-meal.	Dung.
Oil-cake.	Hair and wool.

This list is of course only intended to show the relative solubility of the itrogen in the different substances named. It is not meant to apply rigidly n all cases, nor is it possible to draw such rigid comparisons, for the olubility will vary according to the fineness of division of the material, to ome extent also with the nature of the soil and with the substances with which the manures in question are mixed, for they are seldom applied in a pure state, but are generally mixed with lime, or gypsum, or ashes, and the

nature of this substance will affect their rate of fermentation. The list will serve its purpose if it makes clear the fact that some of these nitrogenous products are more soluble than others, just as some forms of phosphoric acid are more soluble than others, and that the percentage of nitrogen alone is not always a sufficient indication of the value of such a manure unless the source of the nitrogen is also known.

Those products containing their nitrogen in the most inert form, such as hides, horn, hair, &c., are generally utilised by the manure-makers by treatment with sulphuric acid in the manufacture of superphosphates. Their rapidity of decomposition is greatly increased by this treatment, or by mixing with lime they swell up, become soft, and decompose far more readily. They may also be usefully added to the compost heap.

The most important and most commonly used of these products are:—

Dried Blood and Dried Flesh.—These substances are produced in considerable quantity in slaughter-houses and boiling-down works, and are dried by means of steam. They are almost identical in chemical composition and contain on the average 11 to 13 per cent. nitrogen. They are specially beneficial on grass lands (about 30 bushels per acre) for cereals, turnips, and, in fact, all crops that require nitrogenous manures. They are less soluble than such manures as sulphate of ammonia and nitrate of soda, and are more applicable as an autumn manuring than as a top dressing. With superphosphate or kainit they form a complete manure suitable for fruit-trees, vines, potatoes, tobacco, and such crops.

Sulphate of Ammonia is a manure of very great value, and being a waste product in the purification of coal-gas, it can be produced more cheaply than other soluble forms of nitrogen. It is obtained by treating the ammoniacal liquor of the gas works with lime, which drives off the ammonia. The ammonia is absorbed by sulphuric acid and forms sulphate of ammonia. The ammoniacal liquor is a mixture of different ammonium compounds produced in the purification of coal-gas. Sulphate of ammonia is a white crystalline powder when pure. It is the most concentrated form of nitrogen we possess, containing about 20 per cent. of this element in combination. It is readily soluble and immediately available, and specially valuable as a top-dressing to the young crop. For gardening purposes it may be dissolved in water (about ½ oz. to 1 oz. to the gallon), and will be found effective for most pot-plants and flowers. It is more particularly adapted for clay soils. It is stated to be ineffective on strongly calcareous soils, that is, soils which contain over 8 or 9 per cent. of carbonate of lime; but, as the cultivated soils of the Colony appear to average something under 1 per cent., there is not much to be feared on this score. Sulphate of ammonia, or manures containing sulphate of ammonia, should not be mixed with lime, nor applied to land which has been recently limed. A still more effective form of available nitrogen exists in

Nitrate of Soda, the principal source of which is the nitre-beds of Chili and Peru. Enormous quantities are exported to England and the European continent, and it is largely used in imported fertilisers, but its high price as compared with sulphate of ammonia renders its use here prohibitive.

Of other forms of nitrogen may be mentioned

Soot, which contains from 1 to 2 per cent. of nitrogen, principally in the form of ammonium compounds. It is quick in its action, and at the rate of about 30 bushels per acre will be found useful for grass and vegetables. It is particularly valuable for keeping away slugs from vegetables.

Sulphate of ammonia, has also been used for soaking seeds before planting. Wheat is said to germinate more rapidly when thus treated. Experiments published indicate that potatoes previously soaked in a solution consisting largely of sulphate of ammonia, give a much larger yield. The result of some careful experiments by Mr. Gray would show that these statements require to be received with caution, and that the matter requires further investigation before this question can be regarded as definitely settled.

Manures containing Potash.

With the exception of wood-ashes, which have been treated more fully in a previous note (June *Gazette*), we are dependent upon the German potash deposits for our supplies of this invaluable manure. Potash occurs in these deposits in combination with other substances in different minerals of which the commonest is *Kainit*. Kainit is a mixture of sulphates of potash and lime, together with chlorides of magnesium and sodium. It is of value principally on account of its potash of which there is about 12 per cent. For leguminous crops, root-crops, fruit, vines, &c., it is an essential manure. It should always be mixed with other manures, especially phosphatic manures, about 2 cwt. mixed with 3 cwt. superphosphate; 1 or 1½ cwt. sulphate of ammonia per acre being about the best proportion for potatoes. Kainit is the cheapest and the most trustworthy of the potash manures for the farmers use, but the value of wood-ashes must not be overlooked by those who are able to obtain it in quantity. If wood-ashes be substituted for Kainit in any of the formulæ given above, about 4 to 5 times the quantity of wood-ashes must be used, thus half a ton of wood-ashes is about equivalent to 2 cwt. kainit.

Chemical Notes.

By F. B. GUTHRIE.

Analysis of Sorghum.

A sample of sorghum (Coleman variety), grown by Mr. E. Thacker, Sutherland, was submitted for analysis, and shown to contain 13·57 per cent cane-sugar calculated on the whole cane. The cane was grown from seed supplied by the Department. Mr. Thacker reports a yield of 40 tons per acre, and 70 bushels seed.

When the size of the crop, its richness in sugar, and the rapidity of growth (six months) are taken into account, this should prove a profitable crop for the district. The soil was a light loam.

Sugar-Beets.

Three samples of beets were forwarded by Mr. E. Harvey (Crookwell), the results of analysis being as follows :—

	Weight of Beet.	Percentage of Sugar.
No. 1	6 lb. 14 oz.	10·4
No. 2	9 lb. 5 oz.	8·1
No. 3	4 lb. 3 oz.	9·7

A further lot of beets were sent in by Mr. Hibbins, of Tumut, the average weight of which was 3 lb. 1¼ oz., and the average percentage of sugar in whole beet 9·1 per cent. All these beets were obtained from seed of Sutton's Improved, procured from the Department. No. 3 of Mr. Harvey's was, however, a red beet with red top. The Crookwell beets were all very much too large, and badly grown. In my opinion they had been left in the ground too long. It has been clearly proved that the proportion of sugar is invariably greatest in small well-shaped beets, and that when they grow too large, or when the root becomes forked or misshapen, or when side-roots form the sugar diminishes. The weight of a good sugar-beet should not exceed 3 lb. As little as possible of the shoulder should be above ground, and the root should taper regularly. None of these beets are quite rich enough in sugar to pay as a sugar-crop; but there is no reason why their quality should not be considerably inproved by care in cultivation.

ANALYSIS OF GUANO FROM NEW HEBRIDES.

A GUANO, the composition of which is here given, was received for analysis y the Australian New Hebrides Co., Bridge-street.

Moisture...	= 19·55	
Volatile and organic matter ...	= 59·16	(containing nitrogen = 8·1)
Insoluble matter	= 1·86	
Lime	= 6·32	
Phosphoric acid	= 6·18	(calcium phosphate = 13·49)
Alkalies, &c., by difference ...	= 6·93	

About 1 per cent. of the nitrogen was present in the form of nitrates. he ash was of a slightly reddish colour. Its value, according to the above alysis, is £5 8s. 6d. per ton.

This is a good nitrogenous guano, and should be particularly valuable as spring top-dressing to wheat and cereals.

Poultry.

BY S. GRAY,
Sub-Editor.

THE LANGSHAN FOWL.

THE bird dealt with in the present article is one of peculiar interest, quite apart from its admitted value, both as a layer and as a table bird. The breed was first imported into England in the early part of 1872 by the late Major Croad, and exhibited at the Crystal Palace Show following in the class for "Any other new and distinct variety." A somewhat acrimonious discussion promptly commenced as to whether the Langshan was a distinct variety, or an offshoot from the Black Cochin. But when shown in the class for Cochins, says Mr. Wright, most of them were pronounced "bad." It appears, according to the same authority, that the difference of opinion amongst fanciers generally and breeders of the Langshan arose principally from the fact that, while some of the birds exhibited as Langshans had many points in common with the Cochin, others again had distinct points showing a marked difference from that breed. Probably the points which were most noticeable to the casual observer were, first, the difference in the tail, which in the generally accepted Langshan was rather flowing, and slightly "squirrel," the shorter legs and paucity of feathering. Then again the Langshan proper is certainly a more closely-feathered bird than the Black Cochin, and shows a fuller breast, both points, in my opinion, being improvements. The bird is doubtless of Chinese origin.

Bearing these facts in mind, it is somewhat difficult to reconcile the bird which carries off premiums at our shows to the Langshan standard. Our birds most undoubtedly show Cochin characteristics, as appears by the distinct tendency to "cushion," and the close, small-sickled tail. Again, the standard gives the weight of the cock bird as 9 lb., while many of our breeders exceed this considerably. There is, consequently, a little mistake somewhere, and I cannot help coming to the conclusion that the Black Cochin has been used to make the Langshan up for show purposes. I do not wish it to be understood that there is anything wrong in such a course, provided that such a cross has not had the effect of reducing the good qualities for which the Langshan is remarkable. I am quite sure about one point, however, which is, that the particularly long-legged variety is distinctly subject to leg-weakness, a failing which is unknown in the more compact birds. I therefore take the liberty of warning breeders against excess in this direction, and not to sacrifice "utility" to "fancy."

It is safe to say that the Langshan has found many permanent admirers in this country. It succeeds well on the coast and to the west of the Blue Mountains. On the coast the principal breeders are, Mr. W. H. M'Keown, of Gordon; Mr. C. Penrose, of North Willoughby; and Mr. T. Hall, of

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LANGSHANS.

Fairfield. Coming west we find Mrs. Weekes, of Wentworth Falls. Then we have Mrs. W. H. Webb, of Bathurst, a very large breeder of Langshans, to whose kindness I am indebted for photographs of the birds which form the subject of our illustration; while still further west we find Mr. J. P. R. Buckley, Mr. J. G. Moller, and Mr. James Spratt, all of Orange.

It will be seen, therefore, that the Langshan may be successfully kept over a very large portion of the Colony, in fact, on any well-drained soil, and on all hands, I am assured they are good layers and excellent for the table. As layers, it is claimed by Miss Croad, daughter of the original importer, that the hens lay 200 eggs per annum, and the only thing which can be said against them is that the eggs are rather small. I think, however, that 180 eggs per annum will be sufficient to place the breed very high in the scale of layers. As to the quality of the meat, there can be no two opinions; it is white, juicy, and abundant.

I have already explained that Mrs. W. H. Webb was kind enough to provide the photographs from which our illustration was drawn. The male bird is quite young, and was successful in gaining 1st as cockerel at N.S.W. P. P. and Dog Society's Show, 1893, and was bred by Mr. Goodwin, being Mr. M'Keown's strain, and the hen is also a prize winner, having appropriated 1st as pullet at the same society's show of 1892, being bred by Mrs. Webb. I should like to compliment Mr. Valentine, photographer, of Bathurst, for the intelligence and care he displayed in photographing the birds, a feat which breeders well know is extremely difficult to accomplish. I take the following standard from Wright's Book of Poultry:—

Standard of Excellence for Langshans.

(*As issued by the Langshan Society in* 1888.)

Standard of Cock.—*Size.*—In fowls of such remarkable merit as table birds, size must be one of the first considerations, and an adult bird should weigh not less than 9 lb. *Carriage and Shape.*—Sufficiently long in the leg to give a graceful carriage to the body; fine in bone; head carried well back, with full flowing hackle; good wide shoulders, very long broad meaty breast; fan-shaped tail, carried high, with plenty of glossy side-hangers, and two single feathers some 6 inches or more beyond the rest. General bearing, that of an extremely active, intelligent bird. *Comb.*—Red, single, straight, upright, of medium size, fine in quality, and evenly serrated, being free from side sprigs. *Beak.*—Light to dark horn colour, the latter preferred, strong, somewhat straight, well tapered, and somewhat curved at point. *Head.*—Small for size of bird, full over the eye, and carried well back. *Eye.*—Large, bright, and intelligent, and ranging in colour from lightish brown to very dark hazel, with black pupil. *Deaf-ear and Wattles.*—Brilliant red, fine in quality, and medium size. *Neck.*—Sufficiently large to give a symmetrical appearance to, and harmonise well with, the other proportions of the body. *Back.*—Broad at shoulders and rising rather abruptly to tail, the saddle being abundantly furnished with rich hackle. *Breast.*—Broad, deep, and meaty, a long breast-bone being absolutely necessary to the production of "white meat" in excess of offal. *Wings.*—Somewhat low in carriage, and having very brilliant coverts. *Tail.*—Fan-shaped, and abundantly furnished with tail coverts, and distinct sickle feathers projecting beyond the rest for a distance of 6 inches or more. *Thighs.*—Somewhat short, yet large and full, covered with long rather close-fitting feathers. *Legs* (shanks).—Rather long, of a dark slate colour, with the skin under the scales of a light vivid pink; wide apart; a few feathers running down outside the legs and centres of the outer toes on each foot. *Feet.*—The toes should be long and straight, small of bone, and, like the legs, a dark slate colour, with the skin between the scales and toes a light, vivid pink. [This vivid pink should be described rather as a quality than a colour, it being evidence of a thin skin.] Toenails white, the under part of the foot pinkish white. In young birds, the part described as vivid pink should be white. *Plumage.*—Dense black throughout, with a brilliant beetle-green gloss upon it. Purple or blue tinge should disqualify, as should white feathers in adult fowls.* The "tighter" the plumage is the better.

Standard of Hen.—*Size.*—Not less than 7 lb. when fully grown. *Carriage and Shape.*—Gracefully rounded outline, free from that lumpy and squat appearance which results from short breasts and excess of offal; general appearance, that of an active,

intelligent bird. *Plumage.*—Same as cock. *Comb.*—Red, single, medium size, erect, fine in quality, and evenly serrated, coming somewhat to a point at the apex. *Tail.*—Fan-shaped and full, carried rather high. In other respects the hen resembles her mate, as enumerated above.

Scale for Judging.

	Points.
Richness of colour	20
Size	20
Condition	10
Symmetry	15
Fineness of bone	10
Thinness or whiteness of skin and flesh	10
Legs and feet	10
Head and comb...	5
	100

Defects.

	Points.
Bad Colour	20
Want of size...	20
Crooked breast	15
Want of condition	15
Want of symmetry...	15
Coarseness of bone	10
Faulty comb...	5
	100

Disqualifications.—Yellow skin; shanks or feet shaded with yellow; yellow at base of beak or around the eye; vulture hocks; heavy feathering on legs and toes, feathering on middle toes; shanks or outer toes not feathered; white* or coloured feathers; blue or purple sheen; wry tail; white in ear lobe; comb other than single.

* All black-plumaged birds are liable to throw a white feather in certain places, especially after the first adult moult; such feather should not disqualify.

Notes on the Burning of Trash as a Remedy against Parasites and Disease.

By DR. G. KOTTMANN.

DR. COBB, in recommending the firing of the trash on fields with diseased cane in his treatise on gumming (*Agricultural Gazette*, 1893, p. 793), says that it should be done thoroughly.

Great stress should be laid on the last word in the above, as the burning of the trash can be a means of combating a disease only when done differently from the ordinary proceedings which are in vogue for no other reason than to save the trouble of ploughing the trash under.

The trash left on the field after cutting consists of leaves, green tops and stalks, unfit for cutting, these remnants being spread all over the field. In setting fire to them, the leaves are destroyed right enough, but not so the tops and stalks which are only scorched on the outside, their interior being left untouched by the heat of the fire. The microbes in cane suffering from gumming can, therefore, not be destroyed by the ordinary proceedings of firing the trash, and it is necessary to either collect the trash in heaps before setting fire to it, or to collect the remnants of tops and stalks left on the field after the ordinary fire has passed over them, and to destroy them thoroughly by fire.

Such carefulness has even been recommended when the burning of the trash and of all remnants of the cane was given out as a remedy against parasites, although the eggs, larvæ, and pupæ of insects are more easily reached by the fire in the cane than microbes, because they succumb to heat of a lower temperature than the latter, and because, on account of their size, they are necessarily much nearer to the rind than those of the microbes which are seated in the central sap-vessels of the stalks.

For instance, the Commission appointed some thirty years ago to inquire into the best means of combating the borer pest then raging in Mauritius, came to the conclusion—which, however, is not shared by all authorities—that the most practical remedy would be to thoroughly destroy the remnants of the cane crop by fire. In their report they discussed the matter at great length, and said, among other remarks:—"It is necessary to wait until the straw is dry enough to burn well; it is necessary to collect all the remains, to burn them completely a second and third time, or carry them to the furnace."

Of what enormous importance to the fertility of the soil the organic matter is, which is at present destroyed by the cane-growers in the most indiscriminate manner, may be gathered from the following extract from my paper on Disease in Cane, which was published about two years ago:—

"Then, as regards the restitution of vegetable matter to the soil, the importance of this will be recognized when it is remembered that it is this

matter that makes the soil loose, and thus allows access of air, and provides channels for the escape of surplus water, besides supplying carbonic and organic acids which make plant food available from otherwise sterile soil, and in addition, increases the capacity of the land for absorbing and retaining water. To what degree vegetable matter serves the last named purpose may be seen from the following figures:—

"Decaying vegetable matter or humus has been found to absorb 180, red clay 70, and pure sand 25 per cent. of their own weight of water. When exposed to the air for some hours, at a moderate temperature, humus was found to lose 20, grey clay 32, and sand 88 per cent. of the water thus absorbed. Humus, therefore, will soak up 7 times the quantity of rain that pure sand will, and $2\frac{1}{2}$ times as much as grey clay will, and when dried under certain conditions, it will still contain 144, grey clay 48, and pure sand not more than 3 parts of water for every 100 parts of their own weight."

To this may be added that a few farmers who have tried the burying of the trash, have actually found that it allowed them to resume work on the land sooner after rain. This is a matter of great consideration, as at present the land after rain is generally too long left to the mercy of the weeds, and it is easily explained by the greater porosity and soakage capacity imparted to the soil by the buried trash.

The firing of the trash could not be equally condemned if large quantities of organic matter were restored to the soil in some other way, as, for instance, by frequent green manuring. This, however—though its improving effect on the soil has been often brought before the farmers—is a mode of cultivation which is far from being generally adopted on the northern rivers, and which, therefore, cannot be regarded as an excuse for the indiscriminate destruction of the trash.

Notes on Insect and Fungous Pests.*

By C. T. MUSSON,
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WINTER WORK.

WINTER is the time to commence operations against many of the more common orchard pests. The application of a winter spray will do much towards helping trees through the early spring; this is the more important, as many of their troubles come to the young leaves or the young flowers or fruits. In all cases of trees damaged by fungous blights a winter application should be made, before there is any appearance of spring growth; as soon however as spring growth commences summer sprays should be applied and repeated at regular intervals. A few cases requiring particular attention may now be briefly referred to.

Apple.

Scab Cracking or Black Spot.—A bad fungous disease which does much damage. Thoroughly wash the trees with a winter spray, 1 lb. sulphate of iron to 10 gallons water; and follow this up with Ammonio-carbonate of copper during the early period of leafing, and after the fruit has set.

American Blight or Woolly Aphis.—During winter the insects are mostly under ground, therefore in cases of trees usually attacked try and prevent them regaining their above-ground position by fastening round trunk of tree, 1 foot from the ground, a rope or piece of bagging thoroughly saturated with tar and grease. Lay the roots bare, and treat with ash-pit refuse or hot water. Clear all loose bark away from trunk and whitewash it, or brush it with soap and sulphur emulsion, or kerosene emulsion. Later, if the insects regain the branches special efforts must be made to dislodge them, by means of kerosene emulsion or a decoction made from tomato leaves and stems boiled in water or some of the various applications so frequently advised.

Codlin Moth.—Nothing can be done until the spring, when the fruits have set they should be sprayed with Paris Green, 1 lb. to 200 gallons water, 2 quarts of flour being added to the liquid. The spray to be repeated at intervals. The trees should also be bandaged and the bandages searched at regular intervals; all grubs and pupæ found, to be destroyed.

* This article should be read in conjunction with the Fruit Expert's regular monthly directions, p. 593.—ED. *A.G., N.S.W.*

Pear.

Leaf Blight.—A fungous disease requiring same treatment as apple scab. Windsor pears are especially liable to this blight and the crop is often totally destroyed. Timely application of the remedy advised, will, if followed up year after year, eventually save a large proportion of the crop.

Leaf Mite.—A minute spider that lives in galls on the leaves, sometimes doing much damage to them and preventing them from carrying on their full work; the result being poor fruit.

Apply soap and sulphur emulsion or kerosene emulsion when the pest appears.

Stone Fruits.

Peach suffers from curl and leaf rust; apricot from shot-hole fungus.

Apply winter spray, 1 lb. sulphate of iron to 10 gallons water, before any appearance of spring growth. Stone fruits are especially tender and great care has therefore to be used in applying summer sprays; still, applications say at half the normal strength should be tried on a portion of a tree and if no evil result follows, the trees may be safely operated on at the usual intervals, using Ammonio-carbonate of copper or Bordeaux mixture, half strength.

Vines.

Where suffering from "black spot" should be operated on, after pruning, with sulphate of iron 1 lb. to 10 gallons of water or even twice that strength, and in the early stages of spring growth with Bordeaux mixture at regular intervals.

Scale Insects.

Deciduous trees suffering from these pests may be cleaned with a hard brush and should then receive an application of kerosene emulsion or resin wash. This is the more easy to carry out after pruning.

Evergreen trees should receive similar applications at regular intervals.

General notes.

We must conclude that insect and fungous enemies will always be with us. The more we cultivate and tend plants the more subject they become to attack, consequently it has really become a part of our business to try and prevent excessive damage as far as possible. Timely application of remedies such as are likely to attain the required end will help us; neglect of this very evident duty will result in disaster more or less pronounced.

A few general rules need to be followed in applying remedies, particularly when trees are in leaf. Such winter applications as have been herein mentioned can be put on without any danger to the plant by means of an ordinary hand syringe, or in some cases by a brush. For the early spring or summer sprays it is important to note:—

- The liquids should be carefully prepared, and not too strong.
- Should not be applied in a hot sun, nor when plants are in flower.
- Should be applied at regular intervals of from ten to fourteen days, and, in case of heavy rain, immediately the plants are dry. Three or four applications generally sufficient.
- Should not be applied too heavily. Leaves should not be allowed to collect sufficient of the liquid for them to lose it by dripping from the edge.

The liquid should be finely and evenly distributed.
Early treatment is very important.
All weeds should be kept down.
All plants need encouragement in the shape of manurial applications, especially during the early and more tender stages of life.
Strong healthy plants can always resist disease better than weakly ones.
Good drainage is essential; ill-drained ground encourages ill-health, and ill-health begets disease.

In applying sprays, a certain amount of liquid always finds its way to the ground. This cannot be prevented, and, moreover, it is really no loss, as the material will act as a light manure.

I would say once again that the sooner we recognise the absolute necessity for applying ordinary common sense in the way of "doctoring" trees when they are diseased, the sooner we shall successfully cope with one of the greatest problems now before the world, namely, how to secure the greatest possible return from our farms, orchards, and vineyards.

Practical Vegetable Gardening.

Directions for the Month of September.

In many parts of the Colony the ground begins to get sufficiently warm for vegetables of a rather tender nature, and consequently it would be advisable to sow seeds of as many varieties of useful vegetables as would be likely to thrive. It is a mistake to depend on one or two kinds, such as cabbages and pumpkins, which are apparently the most generally grown in the country, when vegetables are grown at all.

Readers of these directions are strongly urged to encourage the growth not only of vegetables, in the first place, but of flowers, ornamental plants and fruit trees, amongst all those farmers and settlers in the country with whom they may come in contact and with whom they may have any influence. There is a lamentable neglect of these things, and every effort should be made by intelligent and thinking persons to have it remedied when possible.

Asparagus.—It may not be too late in cold districts to plant this useful vegetable. If the plants have not begun to shoot they may be safely moved from the seed-bed to their permanent bed.

Arrowroot.—If you have sufficient space in your vegetable garden, plant out some tubers of arrowroot, provided your locality is in one of the warm districts of the Colony. This plant may be seen in patches in many gardens growing without the slightest care, and probably no use is made of it, possibly for a want of knowledge as to how to obtain the starchy matter from the roots. There should be no difficulty in making excellent arrowroot, for all that is needed is a good supply of clean pure water and a rough grater. The latter can be made from a side of a kerosene tin, bent into a half-circle and nailed on a board; but before nailing on the board, knock as many holes through it as you can with a large nail or the sharp end of a file. The writer has used such graters frequently, and they answered admirably for grinding up the roots into a pulp. When sufficient pulp has been ground up it should be allowed to soak in water for some time, then rubbed about and strained on a fine sieve. The starchy matter termed arrowroot will sink to the bottom of the water, which may then be poured off. Frequent washings will be necessary before the starch is sufficiently clean and white for use. It should be spread out on clean cloths in the sun to thoroughly dry, after which it can be put away in bottles or jars until required for use. Children can very soon learn how to manufacture arrowroot suitable for home use. The writer used to make quantities before he had attained the age of ten years. The best kind of arrowroot is made from a small-growing plant, *Maranta arundinacea*, which grows to a height of about 2 feet. This plant is not very plentiful in this Colony, and requires a warmer climate than the arrowroot, *Canna edulis*. Either of these had better be planted about the end of the month. Be sure to thoroughly clean the roots before they are ground up when making arrowroot.

Beans, kidney or French.—A most useful, prolific, and easily grown vegetable, the seed of which should not be sown until frosts are all over. The ground should be well dug, and made as level as possible. If artificial manures are used, those containing a large percentage of ammonia or nitrogen, such as sulphate of ammonia, guano, nitrate of ammonia, blood manure, or soot should be avoided; but superphosphate of lime and potash, old lime rubbish, lime, gypsum, and bone-meal may be applied with every chance of improving the yield of the beans. The seed should be sown in rows 2 ft. 6 in. or more apart. Make drills about 3 or not more than 4 inches deep, and drop the seeds along the bottom of the drills 4 or 5 inches apart, cover with fine soil, and firm down with the back of a spade. Seed, as a rule, is sown too thickly together, and the beans have not sufficient space to grow properly. Two rows of dwarf beans, 15 to 20 feet in length, will be quite sufficient to sow at a time. In about two weeks after sowing put in two more rows, and so on, in order to keep up a continuation of this excellent vegetable. It is advisable to grow the dwarf kinds only, for the runners need to be supported, and this always takes considerable time and trouble which might be better expended on other vegetables.

In the United States of America considerable attention is given, at the Government Experimental Stations, to the testing of varieties of beans, and authentic reports as to their respective merits are published from time to time. If it be possible, similar work will shortly be done with various kinds of vegetables in New South Wales in connection with the Department of Agriculture, and doubtless such good work will prove of considerable value.

Bean, Lima.—This should be treated in the same manner as the kidney bean. The seeds, either in a green or dried state, are used, and not the pods. There is a tall-growing runner variety, and also a dwarf; the first named bears the best beans. Sow the seeds wider apart than those of the French or kidney bean.

Beet, Red.—Sow a little seed of this useful vegetable in drills 1 foot or 18 inches apart, not deeper than 1 inch. As the seed takes sometime to germinate or come up, it can be started into growth if put between damp flannel, or damp bags, in a warm place. As soon as the shells begin to burst, sow in the drills, and then water before covering with soil. As soon as the water has soaked into the soil cover up. Mark the ends of the rows with short sticks, so that you can tell, when weeding the beds, where the plants will come up.

Fresh manure should not be used for this vegetable.

Beet, Silver.—Manure the ground well for this vegetable, in order to induce the growth of good succulent leaves, for the leaves only are used, and not the root, like the red beet. A single row a few feet in length will be sufficient if the plants are well cultivated and sometimes supplied with a good soaking of liquid manure, made from the droppings of animals.

Cabbage.—Sow a little seed in a seed bed. Make little drills about a quarter of an inch deep with your finger, sow thinly, and cover with fine soil. Then get some old, dry cow-dung, break it up fine, and scatter over the surface about a quarter or half an inch deep. This will be found exceedingly useful also for any other kinds of vegetable seeds. It acts as a mulch, and prevents the evaporation of moisture, when sometimes, and not infrequently, necessary watering is forgotten. Do not aim to grow immense cabbages, which are suitable only to feed to cattle, but grow small and medium sized kinds, for they are much more palatable and better flavoured.

Plant out some young cabbages, if you have any large enough to t
plant, to a well-dug, well-drained, and well-manured bed. Use a
dressing of dung, if possible well rotten. Plant in rows about from 2
feet apart according to richness of soil. If the weather is dry, wate
cabbages well as they grow, and also give them occasional supplies of l
manure. Cultivate frequently between the rows, and keep the plants
free from weeds. The more the hoe is used amongst cabbages the b
they will grow. They prefer a rather stiff soil, but will thrive, with a
care and plenty of manure, almost anywhere.

Cauliflower will succeed best at this time of year in the coolest distri
the Colony. Follow the directions given for the cabbage. Plant out
plants, and also sow a little seed in the seed-bed.

Carrot.—A useful vegetable for many purposes in cookery. Sow
rows of the short as well as medium and long varieties. The ground s
be dug up deeply, but not freshly manured. The best kind of soil fo
carrot is a fairly rich, sandy loam, well drained. The rows should be
1 foot to 18 inches apart. Be careful to separate the seeds before so
and cover them with about half-an-inch to an inch of fine soil. As the
generally takes a long time to come up, care must be taken that the t
young seedlings are not crowded out by weeds.

Celery.—Sow some seed in a small seed-bed or box. The soil shou
made very fine. If sown in a box take care to make holes in the bott
the box, put in a layer, about 2 inches deep, of broken stones, c
charcoal, or something similar as drainage, before putting soil into th
Make little drills with your finger, as straight as you can, and sow the
which is very small, as thin as possible. Cover with fine soil, and s
over this some broken up, old, very dry cow-dung. As the plants co
thin them out if they appear to be growing too close together. When
are about 2 or 4 inches high transplant to a well-prepared small bed.
about 4 inches apart, so that they can grow into strong little plan
further planting out into trenches later on.

Cucumber.—In the warm districts seed may be sown towards the e
the month. The ground should be thoroughly well dug up, well ma
and well drained. It is a general custom to make holes about 3 feet
in diameter, and manure the holes, but it would be a much better pr
to manure the whole bed set apart for the cucumbers. The plants m
raised in a seed-bed or box, and afterwards transplanted when their s
leaves have grown. This is, perhaps, better than sowing in the garden
more certain, but it takes a little more trouble. If the seeds are so
the garden, put in at least half a dozen seeds in each place where the p
are to grow, and if all the plants come up they can be thinned out to o
two, and those thinned out can be planted in some other place if ne
It is always better to sow a good many cucumber seeds, as they are gen
unreliable, and numbers fail to germinate. Although special holes nee
be made for the purpose of being manured if the whole bed has been
pared as above suggested, it would be well to make shallow depressio
basins an inch or two deep in which to sow the seed, for this will b
assistance if watering the plants should be necessary.

Endive is a kind of chicory used as a salad generally, although it m
cooked as spinach. It is a good wholesome vegetable, but is not us
much as it deserves to be. Seed may be sown this month in a warm c
where frost cannot attack it. When the seedlings are large enough to h

they may be transplanted to a well-manured bed. Plant out in rows about 15 inches apart, and let the plants stand about 1 foot apart in the rows. Keep down weeds, and when the plants have grown to a good size tie up the leaves together in order to blanch, or make white, the inner leaves. All the plants need not be tied up at the same time, but a few now and then, as they are likely to be required for use.

Leek.—A most useful vegetable, and exceedingly wholesome, generally used in soups, but excellent boiled and served with white sauce. The plant is a most greedy feeder, and needs plenty of manure; in fact it may almost be grown in manure. The best kind of soil for the leek is a sandy loam, moist, but well drained, but it will succeed well on almost any kind of soil if it be well manured. The seed should be sown in a seed-bed, and when the plants have attained a height of 6 or 8 inches they may be transplanted to a bed that has been well dug and heavily manured. Plant deep in rows 18 inches apart, the leeks to be put in about 9 inches from one another. Water well, and from time to time apply liquid manure. The thick stems are generally blanched by "earthing up" the soil about each plant some time before they are required for use. A little experience will soon show the length of time required to blanch them.

Lettuce.—A most useful vegetable for salads. The seed is generally sown in seed-beds in a similar way to cabbage, but at the present time of year it is preferable to sow where the plants are intended to remain. Sow in shallow drills about 18 inches apart. When the seed comes up thin out the plants to about 1 foot apart. The ground should be well manured with rotten dung, and as the lettuces grow give them frequent applications of liquid manure.

Melons, Rock.—Seed may be sown in warm districts, in the same way as was directed for cucumbers.

Melons, Water.—Sow seed also as above, but the plants must be allowed considerably more space.

Okra or Gumbo.—A vegetable bearing a succulent, gummy, or mucilaginous pod, which is used for thickening soups. Suitable for warm climates. Sow seed in a box or seed-bed, and when the plants are large enough to move shift them to a well-manured bed. Let the plants stand about 2 feet apart each way.

Onions.—A good supply of this vegetable is very desirable. The ground should be heavily manured with well-rotted dung. Take care to drain well and make the surface soil as fine as possible. Light, rich, sandy loam is best suited for the onion. Besides rotted dung, soot, blood-manure, ashes, and bone-meal may be used with good effect. Soot mixed with coarse salt is exceedingly useful as a top dressing when the onions have attained some size. Sow the seed in rows 6 inches to 2 feet apart, according to the size of onion it is required to grow. The seed should be merely covered with fine soil, in fact hardly covered at all. When the plants are an inch or so in height, thin them out and transplant, if you like, to another bed. Keep as free from weeds as possible, and stir up the soil occasionally between the plants.

Parsnips.—Sow a few rows in just the same way as was advised for carrots. They are very deep-rooting plants, and the soil should be dug to a considerable depth.

Peas.—A few rows should be sown from time to time, especially in the cool parts of the Colony.

Pepper (*capsicum*).—A plant or two is all that will be needed in a small home garden. The seed may be sown in a box, and the seedlings transplanted when they are a few inches in height. They come to the greatest perfection in the warm climates.

Potato.—Every garden should have a few rows of potatoes if possible. Manure the ground heavily with dung, drain well, and dig deep. Use medium-sized, sound potatoes to plant. Discard small ones altogether. If you can only obtain large ones cut them into two or three sets, and let them be dried by sprinkling with wood ashes and a little lime or dry soil. Make the rows 2 feet 6 inches apart or wider, and plant the potatoes about 6 or 8 inches deep in the soil, 1 foot from each other in the rows. Some of the best varieties are, Brownell's Beauty, Early Rose, and Kidney.

Pumpkins.—Sow a few seeds in ground to be prepared as for cucumbers, using plenty of dung. Sow the seed 6 or 8 in a hole; the holes to be about 8 feet apart, or even more.

Rhubarb.—The present is a good time to sow seed of this vegetable. Roots are generally obtained to plant out and time is thus saved, but in many localities it is difficult to obtain roots when they are required. Sow in drills in a seed-bed, and when the seedlings are large enough to handle transplant to a well dug and well manured bed, where they may remain until large enough to plant in their permanent places. There is no necessity to sow much seed, as a dozen plants will suffice for an ordinary family.

Tomato.—Seed may be sown in the open ground in all the warm districts. The best plan is to sow the seed in a box or seed-bed and transplant the young tomatoes when they are large enough to move. Dig the ground well, but there is no occasion, unless the land is very poor, to apply much manure. This vegetable should on no account be forgotten, for it is useful for a variety of purposes. The small fruiting kinds are perhaps the best to grow, as their fruit has a better flavour than the large varieties. The latter are the most ornamental and useful for marketing purposes, perhaps because appearance only seems to be the general guide in the purchase of such things.

Turnips.—Sow a few rows in drills about 18 inches apart on well-manured ground. It is customary to sow turnips broadcast in vegetable gardens, but this is a mistake, for they can be better attended to, weeded, and thinned if sown in drills. Do not cover the seed with more than half an inch of fine soil.

Vegetable-marrow and Squashes.—Sow seeds in the warm parts of the Colony. The sowing will be the same as that recommended for cucumbers.

Orchard Notes for September.

The commencement of spring is a very important time for fruit-growers, as the success of the season's fruit crop will depend largely on the care bestowed on the orchard now for the prevention of fungus diseases. The early spring is the commencement of active plant growth, and it is also the time that the spores of the various injurious microscopic fungi which are so prevalent throughout the Colony, and which cause such an amount of damage to the fruit industry, start into growth after having remained dormant during the winter, and it is at this stage of their life history that they are most easily and effectually destroyed, or at any rate prevented from doing any great amount of damage, by spraying the trees affected with efficacious fungicides. If the spraying is delayed till the fungus causing the injury has become firmly established, then it is generally too late to save the season's crop; but the right time to spray for the shot hole or scab of the apricot, the scab or Tasmanian black spot of the apple, or the scab or Windsor pear blight of the pear is first when the buds are swelling, and secondly when the fruit is setting. And these two sprayings, properly carried out, will nearly always prevent damage to the crop, or at any rate so minimise the evil that the damage to the fruit is insignificant. The best all round fungicide to use is the Bordeaux mixture, the recipe for making which has been published many times in the *Gazette*, but as this is the time to apply it I will give it again. Bordeaux mixture is made as follows:—

Take 6 lb. of bluestone and dissolve in 2 gallons of boiling water, using a copper, wooden, or earthenware vessel in which to dissolve it, not iron, tin, or zinc, which are destroyed by the bluestone.

Take 4 lb. of unslacked lime and slack it in 2 gallons of water, stirring well. When cool, pour the lime and water, well stirred up (not the clean lime water) through a fine-gauze strainer to keep back any grit or dirt which would tend to destroy the valves of the spray pump, and add the strained liquid to the bluestone water, stirring well. Now add water to the mixture to make the whole up to 22 gallons, and it is ready for use. To apply it use a powerful spray pump and a Nixon nozzle, using as much force as possible so as to drive the spray into every crack and crevice of the tree. Keep the mixture well stirred when using, and cover every part of the tree, but do not flood it. If very thorough work is wished, apply the spray to the tree twice at an interval of an hour or so. The first spraying will then have time to become hardened on the tree, and the second spraying will reach all spots missed the first time, so that the work done is far more perfect. The secret of success in spraying for the prevention of fungus diseases is not to regularly flood the tree, but so to spray that the tree may retain the largest amount of the fungicide used with as little waste as possible, and so that every part of the tree is covered with the fungicide. Where codling moth is troublesome it is advisable when spraying for the scab on the apple or pear to add 1 lb. of Paris green to every 160 gallons of Bordeaux mixture, at

the second spraying, that is, when the fruit is setting, as it is at this time that the moths lay the eggs that form the first crop of worms, in most cases depositing their eggs in the blossom end of the young fruit. By doing this you kill two birds with one stone, viz., keep down the scab and destroy the moth; and Paris green, when mixed with Bordeaux mixture, besides being of considerable value as a fungicide, has a much less injurious effect on the foliage than when used alone, and its properties as an insecticide are not in any way injured. Codling moth should be persistently fought by sprayings at intervals of ten days, the first spraying to be done when the bulk of the blossoms have fallen and the fruit is setting. Even where there is no pear or apple scab present it is a good plan to use the Bordeaux mixture and Paris green combined when spraying first for the moth, as, should the trees be covered with moss or lichen, or have canker or powdery mildew, the Bordeaux mixture will have a very beneficial effect.

The peach aphis must be carefully kept in check, and the best means of doing this were fully described in the August Notes; so I need not repeat them here.

All winter ploughing, all pruning; and all planting should have been completed in August, and the orchard should now be kept well cultivated and free from weeds of every kind. As soon as the young growth takes place, and the shoots are 2 or 3 inches long, then start pinching back the superfluous laterals of apples, pears, and plums, so that the growth of the tree is confined to the permanent branches, and these branches, instead of being long straight limbs devoid of fruit spurs, will be covered with fruit spurs which will often bear fruit the following season, and this fruit will be borne where the tree is best able to carry it, and where it will be protected from wind-storms and sun-burn. All soluble manures should be applied when the trees start into active growth, taking care not to apply too large a quantity at one time to light porous soils, or a quantity is apt to be leached out of the soil by heavy rain and lost. In all cases it is better to apply highly soluble manures in two or more dressings than all at once, as their effect is more lasting, and the trees can make a better use of the plant-food. In young orchards, if desirable, crops may be planted between the rows of trees, but do not plant too close to the trees—5 to 6 feet is quite close enough—or the plants will take the moisture and plant-food required for the proper development of the tree. Peas, beans, cabbages, potatoes, or corn can be grown without injury to the trees, provided the amount of manurial matter extracted by the crop from the soil is returned to the soil as manure. Growing grain crops for hay, or growing pumpkins, &c., between young fruit-trees, is not advisable. If the soil of the orchard is deficient in organic matter and nitrogen, a crop of cow-peas, red clover, vetches, or corn should be planted and ploughed in as green manure. Of these crops the cow-pea is the most valuable as a green manure, and when sown fairly thick it will have the advantage of smothering out such weeds as couch and sorrel, besides its manurial value. Cow-peas should not be sown till all danger of frost is over. Green crop manuring, besides adding nitrogen and organic matter to the soil, would have a very beneficial effect on the heavy, cold, wet soils of Cumberland, as it would tend to lighten the soil and improve its mechanical condition, thus rendering it warmer, more friable, and consequently more easily worked. Good drainage, liming, and green crop manuring combined will do more than anything else to improve the citrus orchards of Cumberland, and, with the careful selection of good varieties for planting, should result in the production of good fruit in the place of the worthless rubbish now glutting our markets.

General Notes.

Produce Commissioner in England.

Taking advantage of the appointment of Mr. Charles R. Valentine to act as Produce Commissioner in England on behalf of the Government of New Zealand, the Government of New South Wales has also appointed that gentleman to act in a similar capacity for this Colony. The want of such an officer has been continually pointed out by gentlemen thoroughly versed in the trade, and it is confidently anticipated that the knowledge of inspection of goods on arrival will tend to check the export of inferior qualities which in the past have done so much to prejudice the extension of our trade in Europe.

A Medicinal Plant.

Forester Allan, of Bateman's Bay, has forwarded to the Department specimen of a medicinal plant known in that locality as "Brook Lime." This is the plant known to botanists as *Gratiola peruviana*. The plant, says Mr. Allan, has been used medicinally by many residents in the Moruya district for years for all manner of complaints, but principally for costiveness, dizziness, and loss of appetite. It is to be found growing in water-courses and marshes, between Ulladulla and Moruya, and no doubt is to be found in other coast districts. It has a small pink flower, and has somewhat the appearance of water-cress. It is very bitter, and is prepared by many in the following manner:—Put a handful in a quart of water, and allow it to come to the boil, and then let it simmer for from ten to twenty minutes. It is then strained, and when cool is ready for use, a dose being a tablespoonful of the liquor twice a day. Some people merely take the plant green and chew it, swallowing the juice. Being a laxative, it acts on some persons like a dose of salts, but not so severe.

The Consulting Botanist, while commending its use as a rural medicine, is not of opinion that it is of any commercial value, as many other drugs are better for the purpose indicated.

Siberian Knotweed (*Polygonum sachalinense*).

We take the following from the *Journal of the Bureau of Agriculture* of South Australia, in case the article referred to has reached farmers in New South Wales:—

One of the Adelaide newspapers, on May 12th, published a laudatory notice of a supposed new fodder plant, introduced as Siberian Knotweed and by other names, which proves to be *Polygonum sachalinense*, an ornamental foliage plant, long since cultivated in France, the young shoots of which, to a small extent, are used as a substitute for asparagus. Mr. M. Holtze, F.L.S., Director of the Botanic Gardens, has already some of the plants

growing, and the Bureau has also supplied him with a few seeds, received from Baron F. von. Muelier. It is quite doubtful if this plant is suitable for any but rich soils in moist localities, and then it is probable that lucerne, clover, meadow grasses, and the usual cultivated fodder plants would give better returns. Mr. Holtze will be able at an early date to report upon the prospects of this plant. A considerable number of letters of inquiry have been sent in to the Bureau concerning this plant.

Export of Hares and Rabbits.

The Department has been devoting considerable attention to this matter, and it is confidently felt that a large business may be done in the export of hares and rabbits to England. If the industry were once started, not only would it give employment to a very large number of persons, but would also reduce the numbers of the pests to such an extent as to materially benefit farmers and pastoralists.

In order that the Department may be in a position to impart for the guidance of those intending to embark in the industry the fullest information possible concerning the requirements of the English markets, Mr. C. R. Valentine—the expert recently appointed in England to attend to the interests of the export trade—has been requested to make inquiries concerning the best methods of sending the carcases to England. Mr. Valentine will also ascertain whether the animals should be prepared and tinned here, or whether they should be shipped in a frozen condition.

Export of Poultry.

It may be of interest to those of our farmers who have facilities for the breeding of poultry on a large scale to know that steps are being taken by the Department to establish an industry in the export of table poultry to England. With this view, the expert in London, Mr. C. R. Valentine, has been requested to obtain full particulars as to the breeds of poultry that are most highly favoured in England for the table, and also any other details as to methods of shipping, &c., that may be thought of value to intending shippers. Arrangements are also being made at the Hawkesbury Agricultural College to prepare a supply of capons, which it is intended to make a speciality, for trial shipments.

AGRICULTURAL SOCIETIES SHOWS, 1894.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindale	Jan. 9, 10.
Clunes Agricultural Society	J. W. Brown ...	„ 17, 18.
Albion Park A. and H. Association	T. Armstrong ...	„ 17, 18.
Kiama A. and H. Association	J. Somerville ...	„ 25, 26.
Holt-Sutherland H. and I. Society	W. Douglas ...	„ 26.
Wollongong A. and H. Association	A. J. A. Beatson...	„ 31, and Feb. 1.
Berry A. and H. Society	A. J. Colley ...	Feb. 6, 7, 8.
Gosford A. H. and I. Association...	H. S. Bevrendge...	„ 9, 10.
Luddenham A. and H. Association	K. Campbell ...	„ 13, 14.
Manning River (Taree) A. and H. Association ...	W. Plummer ...	„ 14, 15.
Lithgow A. and H. Society	M. Asher	„ 15, 16.
Shoalhaven (Nowra) A. and H. Association ...	R. Leeming ...	„ 15, 16.
Ulladulla (Milton) A. Association...	C. A. Cork ...	„ 20, 21.
Marulan P. and H. Society	H. Morrice ...	„ 23.
Kangaroo Valley A. and H. Society	H. Joyce	„ 25, 26.
Candelo A. and H. Association	C. H. Brooks ...	„ 27, 28.
Tumut A. and P. Association	W. H. Bridle ...	„ 27, 28.
Tenterfield P., A., M., and H. Society	J. Harker... ...	„ 27, 28, and Mar. 1
Port Macquarie A. and H. Society	A. E. Poutney ...	„ 28 and Mar. 1.
Lismore A. and H. Society...	C. S. Connor ...	„ 28 and Mar. 1, 2.
Berrima District (Moss Vale) A., H., and I. Society	J. Yeo	Mar. 1, 2, 3.
Nepean District (Penrith) A., H., and I. Society	R. Benaud ...	„ 1, 2, 3.
Robertson Agricultural Society	R. J. Ferguson ...	„ 6, 7.
Uralla P. and A. Association	J. D. Leece ...	„ 6, 7.
Bega A. and P. Association	A. J. Wilson ...	„ 7, 8.
Inverell P. and A. Association	J. M'Ilveen ...	„ 8, 9.
Picton Agricultural Society	G. Bradbury ...	„ 8, 9.
Crookwell A. and P. Association	H. J. Peard ...	„ 8, 9.
Cobargo A. and P. Society...	J. Graham ...	„ 13, 14.
Tumberumba P. and A. Society	W. Willans ...	„ 13, 14.
Glen Innes P., A., and M. Association	J. Denshire ...	„ 14, 15.
Goulburn Agricultural Society	J. J. Roberts ...	„ 15, 16.
Gulgong Agricultural Association...	C. E. Hilton ...	„ 16, 17.
Armidale (Combined Show), A. and P. Association	W. H. Allingham	„ 20, 21, 22.
Taralga A. and P. Association	J. J. Walsh ...	„ 21, 22.
Royal Agricultural Society (Sydney)	F. Webster ...	„ 21 to 27.
Braidwood P. and A. Association...	G. F. Taylor ...	„ 22, 23.
Castle Hill A. and H. Association...	F. H. G. Rogers...	„ 26, 27.
Orange A. and P. Association	J. S. Thomas ...	„ 28, 29.
Walcha P. and A. Association	H. Chapman ...	April 4, 5.
Lower Clarence (Maclean) Agricultural Society...	J. S. Dunnet ...	„ 4, 5.
Camden A., H., and I. Society	W. R. Cowper ...	„ 4, 5.
Gundagai P. and A. Society	W. E. Kyle ...	„ 5, 6.
Blayney P. and A. Association	G. H. Woolly ...	„ 5, 6.
Gundaroo P., A., and H. Association	J. Affleck... ...	„ 6.
Namoi (Narrabri) P., A., and H. Association ...	J. Riddle	„ 11, 12.

Society.	Secretary.	
Bathurst A., H., and P. Association	W. G. Thompson	A
Clarence (Grafton) P. and A. Society	T. Page	
Wellington P. and A. Association	R. Porter	
Hunter River (West Maitland) A. and H. Association	W. C. Quinton	
Dubbo P., A., and H. Association	G. H. Taylor	
Warialda P. and A. Association	W. B. Giddes	
Mudgee Agricultural Society	J. M. Cox	
Williams River (Dungog) A. and H. Society	....	M
Coonamble P. and A. Association	F. R. Salt	
Macleay (Kempsey) A. and H. Association	H. R. Gray	
Gwydir (Moree) P. and A. Association	J. G. Cohen	
Hawkesbury District (Richmond) A. Association	C. S. Guest	
Upper Hunter (Muswellbrook) A. and H. Association	Price Healey	
Upper Manning (Wingham) A. and H. Society	J. J. Herkes	
Central Australia (Bourke) P. Association	J. P. Martin	
Cumnock P. and A. Association	W. Newmarch	
Brewarrina P. and A. Association	H. L. Cathie	J
Nyngan P. and A. Association	E. H. Prince	
Warren P. Association	F. C. Thompson	
Cobar P. and A. Association	A. Roxburgh	
Deniliquin P. and A. Society	H. J. Wooldridge	J
Hornsby, Thornleigh, Pennant Hills, &c., H. Association	H. Epthorp	
Riverina (Jerilderie) P. and A. Society	J. Fulton	
Hay P. and A. Association	F. W. Blanche	
Condobolin A. and P. Society	W. H. Garnsey	
Narandera P. and A. Association	J. F. Willans	A
Forbes P., A., and H. Association	W. G. Dowling	
Corowa P., A., and H. Society	A. A. Piggin	
Northern (Singleton) Agricultural Association	C. Poppenhagen	
Parkes P., A., and H. Association	H. S. Harwood	
Grenfell P. and A. Association	G. Cousins	
Horticultural Society of N. S. Wales	E. S. Sautelle	
Burrangong (Young) P. and A. Association	C. Wright	
Moama A. and P. Association	C. L. Blair	S
Cowra P., A., and H. Association	S. Wright	
Murrumbidgee P. and A. Association (Wagga)	H. T. Davidson	
Queanbeyan P. and A. Society	E. C. Harris	
Burrowa P., A., and H. Association	J. F. Clifford	
Albury P. and A. Association	G. E. Mackay	
Burrowa P., A., and H. Association	J. F. Clifford	
Junee P. and A. Association	M. H. Davis	

Secretaries of Societies are asked to forward dates of forthcomi
as decided.

[4 plates.]

THE

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CONTENTS.

The Dorrigo Forest Reserve.

BY J. H. MAIDEN,
Consulting Botanist.

PART II.—A LIST OF THE PLANTS COLLECTED, WITH DESCRIPTIVE NOTES OF THOSE OF ECONOMIC OR BOTANICAL INTEREST.

(*Concluded from p.* 223.)

WHILE my collecting was chiefly done in the Dorrigo Forest Reserve, a large number of my plants came from the route *viâ* Bostobrick, Tyringham, Bald Hills, Guy Fawkes, Round Mountain, and Wollomombi. The route has been already sketched in Part I.

It is only fair to myself to observe that a large number of specimens from the Dorrigo, which were consigned by me to Sydney per steamer, were detained for several days on the Bellinger River bar. On receipt of this consignment at the Forest Department on Christmas Eve, many of these specimens were found to be quite destroyed, and a large number seriously damaged. This loss was, of course, only discovered by me on my return to Sydney, when I could not remedy it. The Dorrigo plants conveyed by me through New England are safe.

I only remained one day on the Bellinger, as I was anxious to reach the Dorrigo as soon as possible. The Flora of the Bellinger is apparently rich, and had I had the necessary time, no doubt I should have been able to record an enormous number of North Coast District species. This is to explain that the few plants recorded from the Bellinger are merely the result of a hurried journey along the valley.

Clarendon Stuart collected in New England, but "New England," as quoted in the *Flora Australiensis* is so vague, that it is desirable to have more definite localities for some of the plants collected by him.

Volume I. (Flora Australiensis).

RANUNCULACEÆ.

Ranunculus lappaceus, Sm.—At the very summit of the Round Mountain, Guy Fawkes District.

Ranunculus lappaceus, Sm., var. *pimpinellifolius*, Benth.—Bald Hills Station to Guy Fawkes.—A plant hitherto only recorded from Tasmania and the high mountain country of Victoria and the extreme southern part of New South Wales. The present New England locality appears to be new.

Ranunculus plebejus, R. Br. (Syn. *R. hirtus*, Bks. et Sol.)—Bushy plants, 2 feet high in swampy places near Beilsdown Creek.

DILLENIACEÆ.

Hibbertia Billardieri, F. v. M.—Guy Fawkes and Round Mountain.– the very summit of the latter.

Hibbertia diffusa, R. Br.—Very pubescent throughout. Strongly sembles the form of this species found in the Cooma district. Tyring to Bald Hills.

Hibbertia volubilis, Andr. var. *glabra*.—This is the common form of Dorrigo district. It is glabrous throughout, even the sepals having nor the silky hairiness which is so marked a feature of the coast forms. leaves are all lanceolate. I propose the name *glabra* for this well-ma variety. This plant appears to be a good connecting link between *H.* *bilis* and *H. saligna*. The differences between it and the former sp have been stated above. The absence of involucral bracts may also be n It resembles *H. saligna* somewhat in its cluster of floral leaves, but it never found pubescent, as *H. saligna* usually is.

MAGNOLIACEÆ.

Drimys aromatica, F. v. M., var. *pedunculata*.—We have two speci *Drimys* in New South Wales proper, viz., *D. aromatica*, F. v. M., an *dipetala*, F. v. M. *D. aromatica*, is not recorded in the *Flora Australi* for this Colony, but (*Fragm.* vii, 13) it has been found in the Blue M tains, and as far north as the Hastings River. I have collected this sp also on the Sugarloaf Mountain, near Braidwood, a locality which con it with its Victorian localities.

D. dipetala is recorded in the *Flora Australiensis* from the Illaw north along the coast district, and as far west as Mount Lindsay, o Macpherson Range, between New South Wales and Queensland. I also collected it as far south as the Sugarloaf Mountain, Braidwood, a far west as the Blue Mountains (Springwood.)

My specimens of *Drimys* from the Dorrigo are in young fruit, each containing about twelve seeds. The umbels are not only not sessile *Fragm.* vii, 18), but the peduncles are a half to 1¼ inch long in my specin while the pedicels are short (half an inch). In both *D. aromatica* *D. dipetala* the umbels are sessile, and the pedicels are much longer in my specimens. This variety is so well marked that I propose the *pedunculata* for it.

This is the common *Drimys* of the Dorrigo and Glenfernie F Reserves. Particularly in the former Reserve it forms very large are the undergrowth. When I first came across these masses of "scrub," p because of the geographical position of the Reserves, and partly becaus leaves are rather larger than the ordinary forms of *D. aromatica*, I tho it must be *D. dipetala*, but their shape, and the absence of the auric lobes at the base (apart from careful examination of the young fruits, sequently undertaken), settled that (if not a new species) it must come u *D. aromatica*.

ANONACEÆ.

Eupomatia laurina, R. Br.—Bellinger River.

MENISPERMACEÆ.

Sarcopetalum Harveyanum, F. v. M.—Glenfernie Forest Reserve.

Stephania hernandifolia, Walp.—Dorrigo Forest Reserve.—My s mens are rather small-leaved.

VIOLACEÆ.

Viola hederacea, Labill.—The Bellinger and the Dorrigo.

Ionidium suffruticosm, Ging. (Syn. *Hybanthus enneaspermus*, F. v. M.)—A small plant, with yellow or orange flowers, found (mostly growing amongst grass) most of the way up the Dorrigo Mountain.

Ionidium filiforme, F. v. M. (Syn. *Hybanthus filiformis*, F. v. M.)—Guy Fawkes to Round Mountain.—Leaves opposite, with scarcely an alternate leaf.

Hymenanthera dentata, R. Br.—(Syn. *H. Banksii*, F. v. M.)—Rocky banks of creeks (especially near cascades and waterfalls), from the Dorrigo Mountain to Farmer's Falls, Bald Hills Station.—The only difference I can notice in my specimens is that those from lower elevations have longer and thinner leaves.

PITTOSPOREÆ.

Pittosporum revolutum, Ait.—Bellinger River.

Hymenosporum flavum, F. v. M.—Glenfernie Forest Reserve.—Recorded from New England (*Fragm.* vii., 140).

Bursaria spinosa, Cav.—Bostobrick, Tyringham, and banks of Blick's River.—Plentiful.

Marianthus procumbens, Benth.—Bellinger River.

Citriobatus multiflorus, A. Cunn.—Dorrigo and Glenfernie Forest Reserves.—Plentiful.

Billardiera scandens, Sm.—Bellinger River and Dorrigo Mountain.—Unusually velvety pubescent, giving the plant a beautiful appearance. A form like this might well be tried as a creeper to cover trellis, &c.

POLYGALEÆ.

Comesperma retusum, Labill.—Guy Fawkes and Round Mountain.

CARYOPHYLLEÆ.

Cerastium vulgatum, Linn.—A form nearest to *C. viscosum*, Hook (*C. triviale*, Link). Roadsides between Tyringham and Bald Hills.

Stellaria pungens, Brongn.—Damp places in both the Dorrigo and Glenfernie Forest Reserves.

Spergularia rubra, Pers.—Dorrigo Forest Reserve.

HYPERICINEÆ.

Hypericum japonicum, Thunb.—Plentiful everywhere. Collected on the very summit of the Round Mountain, Guy Fawkes district.

MALVACEÆ.

Sida rhombifolia, Linn., "Paddy's Lucerne."—A serious pest on the Bellinger, and spreading on the Dorrigo.

Abutilon oxycarpum, F. v. M.—Bellinger River.

Hibiscus heterophyllus, Vent.—On the Bellinger, and up the Dorrigo Mountain.

STERCULIACEÆ.

Sterculia acerifolia, A. Cunn. (Syn. *Brachychiton acerifolium*, F. v. M.) "Flame-tree."—I have already alluded to this beautiful tree at page 220. It has, of course, been very frequently described. It can hardly be called

plentiful. I noticed it rarely from Bellingen to the foot of Dorrigo Mountain; then, ascending the mountain, here and there it could be observed in the abyss of vegetation below. It is moderately plentiful on the Dorrigo. A very fine specimen was seen in the Glenfernie Forest Reserve, near the pine-mill. It was not again seen going west.

Tarrietia actinophylla, C. Moore. (Syn. *T. argyrodendron*, Benth, var.)—Dorrigo and Glenfernie Forest Reserves.—Locally known as "Ironwood." The name "Stavewood" does not appear to be in use on the Dorrigo. In abundance, magnificent trees, both as regards height and stem-diameter. The trees are very often buttressed. No use is made of the timber locally.

Rulingia pannosa, R. Br. (Syn. *Commerçonia dasyphylla*, Andr.)—Plentiful in the brush near the Bellinger River.

Commerçonia echinata, Forst. Brown kurrajong.—Plentiful on the Bellinger.

TILIACEÆ.

Echinocarpus australis, Benth. (Syn. *Sloanea australis*, F. v. M.) "Maiden's blush."—Dorrigo and Glenfernie Forest Reserves.

Aristotelia australasica, F. v. M.—Dorrigo and Glenfernie Forest Reserves.—A weak-stemmed very spreading bush, about 5 feet high as seen, and at least that in diameter. The species was in full fruit during my visit, and as the fruit of this species has hitherto been imperfectly described, it may be mentioned that in size and external appearance it bears a remarkable resemblance to a red cooking cherry. The berry is as succulent as a tomato, and contains a few brown seeds, somewhat quadrangular, and of the size of mustard seed. In the *Flora Australiensis* the fruit is stated to be "globular, about 4 lines diameter, nearly dry." The flowers, which are not described in the same work, are described in Moore and Betche's *Handbook to the Flora of New South Wales*, page 67.

Elæocarpus obovatus, G. Don. "Blue-berry ash."—Dorrigo Forest Reserve.

LINACEÆ.

Linum marginale, A. Cunn.—Bellinger and Dorrigo.

GERANIACEÆ.

Geranium dissectum, Linn.—Nearly glabrous form; found on the "plains" of the Dorrigo.—Ordinary hirsute form; leaves more deeply lobed than the preceding. Bald Hills to Guy Fawkes.

Pelargonium australe, Willd.—Bellinger River.

Oxalis corniculata, Linn.—The Bellinger, and the less elevated parts of New England.

RUTACEÆ.

Zieria Smithii, Andr.—Normal form. The Dorrigo.

Phebalium squamulosum, Vent.—With leaves up to 2¼ inches long. At the skirts of the brush in various places in the Dorrigo.

Acronychia Baueri, Schott.—Both Glenfernie and Dorrigo Forest Reserves, but not common in either, apparently.

Acronychia melicopoides, F. v. M.—A small tree, about 25 feet high, with dainty white flowers.—Glenfernie Forest Reserve.—Rare. In the *Fragmenta* vii, 145, it is recorded that Mr. C. Moore found this species at the head waters of the Clarence. The description given applies to my specimens.

SIMARUBEÆ.

Cadellia monostylis, Benth.—A slender small tree, say 25 feet high, with not abundant yellow flowers.—About half-way up the Dorrigo Mountain, and apparently rare. In *Fragmenta* vi, 166, and viii, 34, this tree is described as attaining an altitude of 100 feet. It has not hitherto been recorded for further south than the Clarence River.

MELIACEÆ.

Melia Azedarach, Linn. (syn. *M. composita*, Willd.)—White Cedar.—Plentiful on the Bellinger; none on the Dorrigo.

Dysoxylon Fraserianum, Benth, "Rosewood."—A fine tree 5 ft. 6 in. in diameter and 140 feet to the first branch was seen, but although the northern portion of the Dorrigo is full of rosewood (merchantable) say 4 feet in diameter, it does not attain the same magnificent dimensions that it does in parts of the coast districts. Rosewood trees are generally sound, but a drawback to this undoubtedly valuable timber is the circumstance that it takes glue with difficulty, owing, perhaps, to some oleaginous substance in it. Nevertheless, it is a valuable timber, and it is a matter for regret that there are perhaps millions of rosewood trees in the Dorrigo, and yet that there is no demand at present for a single stick of it. I have alluded in a recent number of the *Gazette* (page 366) to the use of this timber for wine-casks. It makes excellent furniture, and I draw attention to this practically untapped and illimitable source of good rosewood. No doubt a demand will set in for this valuable timber before long. Things are bad now with our timber-getters, and they would be satisfied with any reasonable remuneration for it. This is precisely one of our timbers which I would seriously and constantly bring under the notice of the timber-trade in Europe. I have caused a good deal of this timber to be made into various articles, and have seen a good deal of it used in other establishments. I will stake my reputation that this is a valuable timber.

Synoum glandulosum, A. Juss.—On the Bellinger River.

Cedrela australis, F.v. M., "Cedar" or "Red Cedar."—It was the presence of this valuable timber on the Dorrigo which constituted the discovery of the Spaniard whose name the mountain and district bears, and which has largely caused the country to be opened up. There must have been enormous quantities of this timber on the Dorrigo Reserve at one time, but now very few mature trees remain standing, and I did not see one which was fit for cutting. I was told, however, that a few still remain dotted through the forest, but their existence is only known to the timber-getters. A good deal of cedar-planting, under the auspices of the Forest Department, has taken place on this reserve. Unfortunately, Dorrigo cedar is not of a high-class, being pale and porous, and far inferior to Bellinger or "River" cedar in quality. At the same time it is still a valuable timber, and is, at the present time, so low in price that there is no doubt that there would be a much larger demand for it were this fact known to the general public. Glenfernie Forest Reserve once contained a large quantity of cedar, but it is now cut out, owing to its proximity to the Armidale Road. There are only a few small trees now. Some of the cedars in the Dorrigo and Glenfernie had great buttresses.

Flindersia Oxleyana, F.v. M.—A little on the Bellinger and in the Dorrigo.—This would appear to be the most southerly locality yet recorded for the species.

OLACINEÆ.

Pennantia Cunninghamii, Miers.—Glenfernie Forest Reserve. Probably also in the Dorrigo, though I did not notice it there.—The flowers of *Pennantia* are diœcious or polygamous. In Forster's *Characteres Generum Plantarum* (London, 1776), at plate 134, is a figure of a male and a hermaphrodite flower of a New Zealand species. The flowers of the same species (*P. corymbosa*) are similarly figured in Kirk's *Forest Flora of New Zealand.* Female flowers of our New South Wales species (*P. Cunninghamii*) do not appear to have been recorded. Specimens collected by me show hermaphrodite flowers. If we follow the nomenclature of Bentham (*Fl. Aust.* i, 395) and Kirk we should designate these so-called hermaphrodite flowers "female flowers," on the ground that the stamens are infertile; but in my flowers the stamens are pollen-bearing, and it is more correct to retain the term hermaphrodite for them, *i.e.*, the flowers of *P. Cunninghamii.* The hermaphrodite flower shows a perfect pistil, and, had Bentham such material, he would have been able to give a description of the female organs of this plant, to the absence of which, in the specimens sent in by collectors, he draws attention. In all the specimens seen the petals are closed.

CELASTRINEÆ.

Celastrus Cunninghamii, F.v.M.—Large bushes on the tops of the rocky banks of Beilsdown Creek and other water-courses in the Dorrigo.—The leaves are not mucronate, and are more broadly lanceolate than any specimens I have from other parts of New South Wales. All the fruits, when nearly mature, were attacked by the larvæ of a small weevil and destroyed, forming galls, which have the appearance of berries.

Elæodendron australe, Vent.—Small trees, about 30 feet high, and 6 inches in diameter, Dorrigo Forest Reserve. Apparently more plentiful in that portion of the reserve towards Grass-tree. Of a much smaller size on the Bellinger, so far as seen. This white wood should be valuable.

STACKHOUSIEÆ.

Stackhousia monogyna, Labill., (Syn. *S. linariifolia*, A. Cunn.); *S. viminea*, Sm.—Both found on the Dorrigo, and as far as the Bald Hills. The latter as far as the Round Mountain, and on its very summit.

RHAMNEÆ.

Alphitonia excelsa, Reiss.—This tree is locally known as "leather jacket"; (nearer Sydney it is, of course, known as "red ash"). It is found on the Bellinger and in the Orara, but not in the Dorrigo, as far as seen. The behaviour of this timber under the influence of light may not be generally known. When a log is first cut it resembles ordinary ash in colour, and for a long time no change is perceptible. After (say) six months the wood (excepting the sap-wood, which continues to remain pale-coloured), gradually assumes a reddish colour, which deepens for two or three years, by which time it has assumed a fiery-red appearance, hence the name "red ash." When I first gave attention to this timber some years ago, I had a piece so fiery red that I could not believe the colour was natural, and planed the surface, only to find that the colour was only skin-deep, but it returned, in course of time, to its original deep colour. This coloration has not yet been carefully examined, and we are, therefore, unable to give any satisfactory explanation of it. The colouring of red ash, like the colouring of a meer-

schaum pipe, takes time, and this is, of course, a drawback. I know of no other New South Wales timber which has such a striking colour. Another drawback is, of course, its superficial nature. For instance, when used for furniture, if it be touched with a plane, the pale-coloured timber is exposed, making the timber look patchy, until, after the lapse of months, the timber becomes of a uniform deep, red colour.

AMPELIDEÆ.

Vitis sterculifolia, F. v. M. var. *ferruginea*, Glenfernie Forest Reserve.—Beckler collected, on the Hastings River, a specimen, "which is slightly rusty pubescent" (B. fl. i, 450), but my specimens—every part of them—are densely rusty or ferruginous pubescent. Even the upper surface of the leaves is only glabrous in mature specimens. This plant is so different in general appearance to the type form that I propose to designate it *ferruginea*.

SAPINDACEÆ.

***Diploglottis** Cunninghamii*, Hook. f. "Tamarind."—On the Bellinger River and in the gullies ascending the Dorrigo Mountain are magnificent specimens of this species, some of them attaining a height not far short of 100 feet. The long bare stems are crowned with the very large pinnate leaves, amongst which are clustered enormous quantities of the fruit, known as "tamarinds." These fruits are very acid, and although differences of opinion may occur as to the palatableness of them, no one will fail to admire the handsome appearance of the masses of orange-coloured fruit. A tamarind tree in full-bearing is one of the most strikingly handsome trees in coastal Australia. On the Dorrigo Reserve itself there are only a few large tamarinds which bear fruit. Here and there are a few saplings (say) up to 10 or 20 feet high, but most of all the fruit-bearing trees would appear to have been cut down. It is not, however, likely that the tree attains the same luxuriance in the Dorrigo that it does lower down, near the coast.

***Castanospora** alphandi*, F. v. M.—There is a magnificent tree of this species about half-a-mile from the post office at Bellingen, on the Fernmount side. It stands by the side of the road. It is about 50 feet high, with a stem diameter of about a foot. Its branches extend nearly to the ground, and it would be difficult to imagine a handsomer tree. At the time of my visit its dense, dark foliage was set off by a profusion of obscurely-angled fruit, hanging in clusters, and of the size and general appearance of peaches. Each fruit contained one to three seeds, resembling horse-chestnuts. I feel sure that this tree would speedily become a favourite in gardens in the warmer coast districts. The seeds are exceedingly liable to destruction by maggots. It would be desirable to sow them in boxes directly they are gathered. It is long since I saw an ornamental tree which impressed me so favourably, and I hope that a special effort will be made to propagate it. It would appear to be rare. No one to whom I spoke knows of another in the Bellinger district, so this particular tree may be referred to in the statement "Ad fluvios Tweed et Bellinger's River, Carron." (*Fragm.* ix, 92).

Cupania semiglauca, F. v. M. (Syn. *Nephelium semiglaucum*, F. v. M.)—Banks of the Bellinger River, near Bellingen.

Ratonia stipitata, Benth. (Syn. *Cupania stipitata*, F. v. M.)—On the Dorrigo this tree attains a height of from 60 to 80 feet, and has a diameter of 1 to 2 feet. It is known there as Brush Cherry or Myrtle, but I am inclined to think, perhaps, from confusion with *Eugenia myrtifolia*, as its handsome fruits bear some resemblance to those of that species.

Nephelium subdentatum, F. v. M.—Glenfernie Forest Reserve.—Nearest previously recorded locality, Clarence River (*Fragm.* ix., 99), but this new locality is some 80 miles south of this.

Nephelium, aff. *Beckleri*, Benth.—A small tree, not rare in the Dorrigo and Glenfernie Forest Reserves. In flower only. Appears to differ from *N. Beckleri* in the more lanceolate shape of the leaves, the more pinnate disposition of the principal veins, which also appear to be more prominent above than in *N. Beckleri*. My *Nephelium* has dainty pink petals. The flowers also are much more numerous than in auy *N. Beckleri* I have seen. I have another plant from the Dorrigo closely allied to the above. The venation of the leaves and structure of the flowers are very similar, but it is much less floriferous. I am unable to speak more positively in regard to these two plants in the absence of fruits.

Harpullia pendula, Planch. "Tulip."—This tree, valued on account of its durable and highly ornamental timber, is not uncommon, both on the Bellinger and in the Dorrigo. In these localities it is not nearly so handsomely marked as samples from the Richmond River and further north. It would appear not to have been previously recorded from further south than the Clarence River.

Akania Hillii, Hook. f.—Dorrigo Forest Reserve, abundant. Hitherto not recorded from further south than the Clarence River, so far as I am aware.

Volume II.

LEGUMINOSÆ.

Oxylobium trilobatum, Benth.—Tyringham to Round Mountain and Guy Fawkes.—Found on the very summit of the mountain.

Jacksonia scoparia, R. Br.—First seen near Bostobrick (though it is probably not rare in the Dorrigo); thenceforward a good deal throughout New England.

Daviesia latifolia, R. Br.—Throughout New England, but apparently more common west of Guy Fawkes.

Daviesia genistifolia, A. Cunn. (?) var. *colletioides*, Benth.—Guy Fawkes and Round Mountain.—The leaves of this plant are unusually stout, and up to a maximum length of $\frac{5}{8}$ inch. Under var. *colletioides* (B. Fl. ii., 82), Bentham says the leaves of the normal species and this variety are "never flattened horizontally." The lowest leaves of my specimens are certainly flattened horizontally, while the others are linear-terete, and some of them more or less sulcate. Found on the very summit of the mountain.

Pultenæa flexilis, Sm., var. *mucronata*, Benth.—Apparently not common. I only saw one plant (a bush about 5 feet high), and that was near Grass Tree Nob. This form was first collected by Beckler, at the Clarence River, and this new locality extends its range perhaps 100 miles to the south.

Dillwynia ericifolia, Sm., var. *parvifolia*, Benth.—Guy Fawkes and Round Mountain; on the very summit of the latter. Hitherto recorded no nearer than from the Blue Mountains. I also collected the normal form of *D. ericifolia* on the Round Mountain.

Dillwynia ericifolia, Sm., var. *phylicoides*, Benth.—Guy Fawkes and Round Mountain; on the very summit of the latter. Hitherto recorded from the Blue Mountains and "Mount Mitchell" (Beckler). Mount Mitchell is a few miles north-west of Ben Lomond.

Platylobium formosum, Sm.—Bellinger River.

Bossiæa prostrata, R. Br.—Plains of the Dorrigo.

Hovea longifolia, R. Br., var. *lanceolata*, Benth.—On the sides of the Wollomombi Gorge. A bushy scrub 6 feet high.

Lotus corniculatus, Linn.—Bald Hills to Guy Fawkes, rather abundant, but probably well diffused in other New England localities.

Indigofera australis, Willd.—Not rare in the Dorrigo; also found between Tyringham and Bald Hills.

Milletia (*Wistaria*) *Maideniana*, Bail.—Very common in parts of the Dorrigo.

Swainsona galegifolia, R. Br.—Tyringham to Bald Hills.

Zornia diphylla, Pers.—Very abundant in grass-land in the Dorrigo, and thenceforward at least as far as Bald Hills.

Desmodium varians, Endl.—Plains of the Dorrigo.

Lespedeza cuneata, G. Don.—On the banks of Glenfernie Creek, Glenfernie Forest Reserve. Apparently rare.

Glycine clandestina, Wendl., var. *sericea*, Benth.—Bald Hills to Guy Fawkes.

Vigna vexillata, Benth.—Bellinger River.

Derris scandens, Benth.—Dorrigo Forest Reserve. Not hitherto recorded for south of the Clarence, so far as I know.

Castanospermum australe, A. Cunn. "Bean-tree."—Extends as far south as the Dorrigo Reserve, but not very abundant as far as seen. Some of the trees have large buttresses.

Acacia juniperina, Willd.—Guy Fawkes, and right at the top of the Round Mountain. I cannot find any difference between this form and that of the same species from the south coast, *e.g.*, Cambewarra, Moruya.

Acacia penninervis. Sieb., var. *falciformis*, Benth.—Guy Fawkes and Round Mountain. Forming dense belts of a scrubby growth up to 8 or 10 feet high in various localities about Guy Fawkes, and up to within a very few feet of the very top of the Round Mountain. Young shoots and inflorescence minutely hoary or golden-pubescent, phyllodia falcate, but rather small at the highest elevations.

Acacia melanoxylon, R. Br. "Mudgerabah" or "Blackwood."—Bellinger district, thence through the Dorrigo and onwards into New England at least as far as Guy Fawkes. For an account of this interesting tree see *Agricultural Gazette*, page 129 (March, 1894), where its remarkable geographical distribution is discussed, and it is fully described. In New England it is known as "Mudgerabah," people being unaware that it is the same tree as the blackwood of Tasmania and Victoria.

Acacia binervata, D.C.—Acacia is a rare genus in the Dorrigo. This species was observed on the Bellinger, then again at Bostobrick, and thenceforward at various places in New England.

Acacia Cunninghamii, Hook.—Bellinger River, also Dorrigo Forest Reserve, skirting the scrub at the tops of the banks of creeks.

Acacia decurrens, Willd, var. *α*.—Guy Fawkes to Wollomombi.—Found on the summit of the Round Mountain. A variety new to me, and intermediate between *mollis* and *Leichhardtii*. It is remarkable for the excessive fineness and shortness of the pinnules, in which it approaches *pauciglandulosa*. It is hardly so soft as *mollis*, but has the yellow tinge to the young shoots so often seen in that variety. It is, however, chiefly to be noted because of the glands. They are small, urceolate, and unusually symmetrical in proportion. I have not hitherto noticed similar glands on any form of *Acacia decurrens*.

Acacia decurrens, Willd, var. *β*.—This wattle was first seen about Bostobrick, and thence to Tyringham. It is less pubescent than *mollis*, and has

the beautiful golden-yellow tips of that variety. Branchlets less prominently winged than those of the variety *normalis*, but not less than any of the other varieties. Pinnæ, fifteen to twenty pairs and more. Leaflets (pinnules), thirty to fifty, as far as seen. More distant and longer than those of *mollis*. Obtuse, and as long as those of some forms of *normalis*. *Glands*.—One (a prominent) gland at the base of the lowest pair of pinnules. There appear to be no glands on the main rachis, except a few towards the tip. A striking feature of this variety is the great length and rigidity (erect or "strict" growth) of the general or primary rachis. The position of this variety appears to be between *normalis* and *mollis*. I have given no distinctive names to these two varieties, as I am disinclined to add to the already cumbersome list of varieties. I find more and more evidence of the infinite variation of this species (*Acacia decurrens*).

ROSACEÆ.

Geum urbanum, Linn.—Bald Hills to Guy Fawkes.—Not previously recorded, I believe, from further north than the Macleay River.

Rubus parvifolius, Linn.—Found from the Bellinger to beyond the Bald Hills. Just outside the Dorrigo Forest, and looking towards the Little Murray River, a form with exceedingly small leaves (not exceeding half an inch across, the form, no doubt, to which the species owes its name), was found amongst the grass, and its pleasant fruit was much appreciated. The specimens from the Dorrigo and from the Bald Hills are very much larger than these. The Dorrigo leaves are mostly ovate-lanceolate, and certainly not orbicular. The species is, of course, exceedingly variable, and the contour of the leaves of some of these forms closely approximates to that of *R. moluccanus*, Linn.

Rubus Moorei, F. v. M.—This uncomfortable plant was found on the Bellinger.

Acæna sanguisorbæ, Vahl.—This plant was found by the side of all roads in the plains of the Dorrigo, and thenceforward at least as far as Bald Hills Station. This weed is, of course, disseminated by means of its hooked fruits, which attach themselves to animals and the clothing of human beings. A New England squatter to whom I spoke about it did not look upon it as a serious pest, as he stated that it appeared to him to keep near stumps, big stones, &c., and not to seriously interfere with open pasture.

Rosa rubiginosa, Linn. "The Sweetbriar."—I did not notice this pest till I got into the neighbourhood of Armidale. I am informed, on good authority, that, as far as New England is concerned, it is chiefly confined to the coast range and table-land, say from Tenterfield to the Moonbi Ranges.

SAXIFRAGEÆ.

Cuttsia viburnea, F. v. M.—A beautiful small tree just at the top of the Dorrigo Mountain. Not common. Bears abundance of white or creamy white flowers, and has handsome foliage. Would be an acceptable addition to gardens. This specimen has leaves not so distantly serrated as those which are figured, *Fragm.* v, 47, which are from a Tweed River plant. In *Fragm.* vi, 189, the species is recorded from the Macleay, Bellinger, and Clarence. The Dorrigo Mountain locality is worthy of record, as I found the species several miles away from the Bellinger, up the mountain.

Quintinia Sieberi, A.DC.—Beilsdown and other creeks, Dorrigo Forest Reserve.—Apparently not abundant. I did not find *Q. Verdoni*, F. v. M., in the Dorrigo.

Callicoma serratifolia, Andr.—Glenfernie Forest Reserve.—Leaves softly rusty tomentose underneath, and no doubt the *C. ferruginea*, Don., referred to in B. Fl. ii, 440.

Schizomeria ovata, D. Don, locally known as "Crab Apple."—Up to 5 feet in diameter and more, and 90 feet to first branch. Abundant in the Don Dorrigo Reserve. Not rare in the Glenfernie Forest Reserve, but apparently not attaining the same size as in the Dorrigo, where it ranks amongst the giants of the forest. It is one of the brush trees with large buttresses.

Ackama Muelleri, Benth. (Syn. *Weinmannia paniculosa*, F. v. M.)—In the Dorrigo and Glenfernie Forest Reserves, but apparently more abundant in the latter.—A magnificent tree of great height, with corky bark, hence the name "Cork-tree," or "Cork-wood." Ferns, mosses, and orchids are commonly found on this tree. My specimens have leaves all either perfectly entire, or with serrations so small as to be detected with difficulty. In the Dorrigo Forest Reserve (and, perhaps, also in Glenfernie), there is a form of this species with softly tomentose leaves and young shoots, and with the leaves more digitate than in the type form. This is evidently the plant referred to by Baron von Mueller (*Fragm.* vi, 188), from Camden Haven, the Macleay, and the Bellinger. The Dorrigo is, therefore, an important additional locality. The variety is so marked that I would suggest to the Baron the propriety of designating it *tomentosa*.

CRASSULACEÆ.

Tillæa verticillaris, DC.—Bellinger and Dorrigo.

DROSERACEÆ.

Drosera spathulata, Labill.—Bellinger.

HALORAGEÆ.

Haloragis micrantha, R. Br., and *H. tetragyna*, Hook. f.—Bellinger and Dorrigo.

Myriophyllum variæfolium, Hook. f.—Pools at Little Plain, Dorrigo Forest Reserve.

Volume III.

MYRTACEÆ.

Bæckia diosmifolia, Rudge.—In swampy land on the Round Mountain, near Guy Fawkes.—The occurrence of this species in New England, and at such a high elevation, is interesting.

Bæckia virgata, Andr.—Bellinger River.

Leptospermum flavescens, Sm.—Dorrigo Forest Reserve, thence to Guy Fawkes and Round Mountain.—The plants from the Dorrigo (under 3,000 feet) differ but slightly from those from the Round Mountain (over 5,000 feet), and, apparently, chiefly in the size of the leaves, which in the Dorrigo forms are up to ¾-inch in length, and in the Round Mountain form are more numerous, and do not exceed ⅜-inch in length.

Leptospermum stellatum, Cav.—About the Guy Fawkes Falls.—This New England locality is apparently new. It has previously been recorded from the Blue Mountains. (See my remarks under *L. attenuatum*.)

Leptospermum attenuatum, Sm.—Bald Hills Station to Guy Fawkes.—The plant collected is very similar in outward appearance to the form of *L. stellatum* collected in the same district; so similar, that in my first classification, I considered them to belong to the same species, but they may be readily distinguished by the pedicellate flowers of *L. attenuatum*. The form of *L. attenuatum* collected by me is evidently that alluded to by Bentham (B. Fl. iii, 108), as "leaves small or middle sized, often somewhat cuneate, almost passing into *L. stellatum*."

Callistemon salignus, DC., var. *angustifolia*, Benth.—Forms much of the bank-side vegetation near the Bridge over the creek at Wollomombi (Wollomombi Creek). Straggling high shrubs, 10 to 15 feet high.

Callistemon salignus, DC., var. *hebestachyus*, Benth.—Beilsdown Creek, Dorrigo Forest Reserve.—A patch on the banks of the creek near Coghlan's, but not very plentiful as far as seen. Also on the banks of Blick's River, near Tyringham. The resemblance of the foliage of this variety to *C. coccineus* is very striking. This variety has hitherto only been recorded from Victoria and Tasmania, but I have no doubt of the correctness of my present diagnosis.

Callistemon salignus, DC., var. *Sieberi*, F. v. M.—Guy Fawkes and Round Mountain.—Very closely resembling the form found in the Braidwood district. The present locality is interesting. The above three forms of *C. salignus* seem to be quite different from each other. I did not observe the typical form so common in the coast districts, though careful search will probably bring it to light on the Bellinger.

Melaleuca linariifolia, Sm. "Narrow-leaved Tea-tree."—Found on the coast, Bellinger River district.

Melaleuca Leucadendron, Linn. "Broad-leaved Tea-tree."—This is plentiful on the coast in and about the Bellinger River, and is found up to 18 inches in diameter.

Melaleuca styphelioides, Sm. "Prickly-leaved Tea-tree."—This species is found on the coast near the Bellinger, where it contains a stem diameter of 12 to 20 inches.

Angophora. Apple-tree.—No *Angophora* (apple-tree) of any species was observed either on the Bellinger or in the Dorrigo.

EUCALYPTUS.

In dealing with this genus I propose, as a preliminary to my few notes on each species, to give a general account of the Eucalyptus vegetation as observed by me on the trip. It will be most convenient to divide the trip into sections.

1. Bellinger River, especially near the coast.—There were found swamp mahogany (*E. robusta*), red mahogany (*E. resinifera*), and a little white ironbark (*E. paniculata*). Further up the river came tallow-wood (*E. microcorys*), and a few trees of blue gum (*E. saligna*).

2. Dorrigo Mountain and Dorrigo Forest Reserve.—On the lower elevations of the mountain were found tallow-wood, red mahogany, a little grey gum (*E. punctata*), while skirting the edge of the reserve itself there is but one eucalypt, a white gum (*E. viminalis*).

3. Dorrigo to Perrett's (Tyringham), *via* Bald Hills and Bostobrick.—White gum (*Eucalyptus viminalis*) along the ridges, skirting the scrub and creeks. This is the prevalent gum till Bostobrick is reached. It is admixed between the Little Murray River and that station with messmate (*Eucalyptus amygdalina*); thence to Perrett's there is a good deal of blue gum (*E. saligna*)

and red gum (*E. tereticornis*), together with a second white gum (*E. viminalis*, var. *diversifolia*) mixed with a little white mahogany (*E. acmenoides*). Very few of the hardwoods along this route are well-grown, merchantable trees. Messmate is known in this district as white stringybark. On the watershed, between the Blick's River and the Nymboida, is a magnificent forest of mature tallow-wood (*E. microcorys*), with blackbutt (*E. pilularis*), also a little turpentine (*Syncarpia laurifolia*), with white gum (*Eucalyptus viminalis*) fringing the forest. This is a maiden forest full of grand timber, but practically inaccessible under present circumstances, and with the poor local demand for hardwood. The get-out for the timber of this forest would be along the range to the Long Flat, about 1½ mile from Perrett's.

4. Perrett's to Glenfernie Forest Reserve.—The hardwoods are red gum (*E. tereticornis*) and messmate (*E. amygdalina*), locally known as stringybark. These two timbers are cut in limited quantity at Glenfernie mill, under the names of red gum and stringybark. There is no true stringybark in the district, except a few odd trees of *Eucalyptus capitellata*. There is some white gum (*E. viminalis*, var. *diversifolia*), also a little white mahogany (*E. acmenoides*), also some turpentine (*Syncarpia laurifolia*) of fair size in the gullies. No doubt this fact will be borne in mind by those interested in supplying piles for the bridges of the district.

5. Following are the eucalypts observed at and around Guy Fawkes :—White gum (*E. pauciflora*), abundant everywhere from the Bald Hills onward. Sally, slaty, or lead-coloured gum (*E. stellulata*), a stunted tree, like the preceding, abundant in bleak grass-land. Peppermint (*E. piperita*, Sm.), between Guy Fawkes and Wollomombi. Box (*E. hemiphloia*, F. v. M). This timber first appeared about Major's Creek, and is plentiful along the route, *via* Bald Hills to Guy Fawkes. Red stringybark (*E. capitellata*, Sm.) and a little stringybark (*E. eugenioides*, Sieb.).

6. Guy Fawkes to Wollomombi.—Box (*E. hemiphloia*), abundant; peppermint (*E. piperita*) and messmate (*E. amygdalina*).

Eucalyptus stellulata, Sieb. "Lead-coloured Gum."—A stunted gum found at high elevations, smooth-barked, and looking as if it were blue or lead-coloured with the cold. I found it from Bald Hills to Guy Fawkes, and right on to the Round Mountain. [See *E. pauciflora*.]

Eucalyptus pauciflora, Sieb. (Syn. *E. coriacea*, A. Cunn.) "Cabbage or White Gum."—One of the commonest gums in New England. Not particular as to soil or situation, but apparently attaining its greatest luxuriance in the troughs of undulating well grassed land. It extends right to Guy Fawkes and the Round Mountain, it and *E. stellulata* being the only eucalypts which occur in abundance at these altitudes.

Eucalyptus amygdalina, Labill. "Messmate."—Very abundant. First seen about Tyringham, and then at least as far as Wollomombi. Found on the very summit of the Round Mountain. At Bald Hills Station, Mr. Walter Beauchamp showed me posts of this timber which had been down from ten to fifteen years, and which were still sound. This timber lasts even longer in damp ground. This worthy of note, as *E. amygdalina* is not usually considered durable for the purpose stated.

Eucalyptus capitellata, Sm. "Red Stringybark."—About Tyringham and Blick's River, thence to Guy Fawkes and the Round Mountain.—A tree grew on the very summit of this mountain; wood hard and very red, hence the local name of "Red Stringybark."

Eucalyptus eugenioides, Sieb. A "Stringybark."—Found on the very summit of the Round Mountain.

Eucalyptus pilularis, Sm. "Blackbutt."—I draw attention to the occurrence of this timber on the watershed between the Blick's River and the Nymboida. It is apparently uncommon on New England, as far as observed by me preferring the coast districts.

Eucalyptus acmenoides, Schau. (Syn. *E. triantha*, Link).—A little noticed about Bostobrick.

Eucalyptus hæmastoma, Sm., and *E. Sieberiana*, F. v. M. (Syn. *E. virgata*, Sieb.)—Less than 100 yards inside the brush of the Glenfernie Forest Reserve, and at least as far as Blick's River to Bald Hills, is a large tree, with brown, peppermint-like bark, which seems to be intermediate in character between *E. hæmastoma* and *E. Sieberiana*. The tree would appear to be very widely distributed in New England, for specimens collected by Mr. Henry Deane, at the Bluff River, near Tenterfield, cannot, in my opinion, be separated from my specimens. Of course the typical *E. Sieberiana*, with bark of the appearance of an ironbark, free-grained timber, and conoid fruits (with pedicels hardly separable from the fruits), is at once distinguishable from the smooth-barked *hæmastoma*, usually of crooked growth, inferior timber, and with the fruit having a tendency to a hemisphere, leaving a distinct pedicel. But my specimens seem to be intermediate in character. The peppermint-like (*E. piperita*) bark is very different in appearance to that of the true *E. Sieberiana*, and while the veins of the leaves of *E. Sieberiana* are usually less conspicuous than those of *E. hæmastoma*, I cannot satisfy myself to bring the leaves of my plants into one species rather than into the other. To show the difficulty of the situation, some of my specimens (Tyringham to Bald Hills), I would place under *E. Sieberiana*, if I had not seen other specimens from the same district, which I would have placed under *hæmastoma*. To sum up, having considered the fruits, leaves, barks, and timbers, I can only observe that my particular New England specimens (called by the few local residents "messmate" and "peppermint" indiscriminately), must for the present be looked upon as a connecting-link between *E. hæmastoma* and *E. Sieberiana*.

Eucalyptus microcorys, F. v. M. "Tallow-wood."—Lower elevations of the Dorrigo Mountain. Also, watershed between Blick's River and Nymboida.

Eucalyptus paniculata, Sm. "White Ironbark."—A few trees on the Bellinger, between the south and north arms. There is no other ironbark on this river.

Eucalyptus robusta, Sm. "Swamp Mahogany."—On the coast, near the Bellinger.

Eucalyptus resinifera, Sm. "Red Mahogany."—Is found, at intervals, the whole of the way between Nambucca and Coff's Harbour, and on the lower parts of the Dorrigo Mountain.

Eucalyptus saligna, Sm. "Blue and Flooded Gum."—Banks of the Bellinger River. Seen again about Bostobrick. Since my return, Mr. Forester MacDonald has sent this species from the side of the cutting, Dorrigo Mountain, under the name of "Messmate" (*sic*).

Eucalyptus punctata, DC.—A little was seen about a third of the way up the Dorrigo Mountain.

Eucalyptus viminalis, Labill. "White Gum."—When once the Dorrigo Mountain is ascended, and one is fairly on the reserve, it will be found that there is but one species of Eucalyptus, a white gum. It is to be found all over the reserve, on the open country, fringing the plains fronting the Beilsdown, Murray, and Nymboida Creeks. It is a typical *E. viminalis*. The timber of *E. viminalis* is usually looked upon as the reverse of durable; in fact it bears a very bad name. But this Dorrigo white gum timber is any-

thing but useless. It is not first-class, but it is a good timber. I was shown a stock-yard which had been made of this timber thirty years ago (there is no other Eucalyptus timber anywhere near), and posts and rails were but little the worse for wear. I carefully examined the timber, and into the circumstances of its use, and the value of *E. viminalis* timber has certainly increased in my estimation.

Eucalyptus viminalis, Labill. var. (Syn. *E. diversifolia*, Bonpl.)—This is a white gum, which is the *E. diversifolia* of Bonpland, but which is now usually considered to be a form of *E. viminalis*. It was first seen about Bostobrick, and thenceforward was seen a good deal in New England. About Guy Fawkes and the Round Mountain is a form with exceptionally small fruits.

Eucalyptus tereticornis, Sm. A "Red Gum."—Apparently not very abundant in New England. It was mixed with *E. saligna* and *E. viminalis* var., between the Little Murray and Tyringham, especially about Bostobrick, but the relative proportions of these (mainly) smooth-barked timbers could not be stated with even an approximation to accuracy, except with far more time than I was able to give.

Eucalyptus corymbosa, Sm. "Bloodwood."—On the Bellinger.

Eucalyptus maculata, Hook. f. "Spotted Gum."—This occurs between the south and north arms of the Bellinger, but only up to 18 inches in diameter.

Tristania conferta, R. Br. "Brush or White Box."—Abundant in the brush up to a few miles from the coast, Bellinger River district. Magnificent trees, over 150 feet high, were seen, and with a trunk-diameter in proportion.

Tristania laurina, R. Br. "Water Gum."—On the banks of the Bellinger, 2 feet 6 inches in diameter. Some fine trees also in moist situations in the Dorrigo Forest Reserve (Beilsdown and other creeks); also, in the same reserve, a very small-leaved form that might be casually mistaken for *T. neriifolia*.

Syncarpia laurifolia, Ten. The Turpentine.—Some magnificent trees of this species were found in the gullies of the Glenfernie Forest Reserve. Its presence in this reserve does not appear to be known, at least generally; found also on the watershed between the Blick's River and the Nymboida. As I have fully described the timber in the *Gazette* for July, I need not repeat myself here.

Backhousia myrtifolia, Hook, et Harv., "Grey Myrtle." — Along the Bellinger River, but not abundant, as far as noticed by me.

Myrtus rhytisperma, F. v. M.—Foot of Dorrigo Mountain, shrubs 3 or 4 feet high, with yellow or orange-coloured fruits. I should have referred this plant to *M. rhytisperma* without hesitation, except that the seeds cannot be called "few," as those in each fruit average nearly fifty.

Rhodamnia argentea, Benth.—Common in the Dorrigo Forest Reserve, and probably in Glenfernie also.

Eugenia Ventenatii, Benth.—Very abundant on the banks of the Bellinger River.

Eugenia myrtifolia, Sims. "Brush Cherry."—Dorrigo and Glenfernie Forest Reserves, and Bellinger River.

Eugenia parvifolia, C. Moore.—This is the small-leaved *Eugenia*, with characteristic pear-shaped fruits. It is exceedingly abundant on the Dorrigo, particularly in the Beilsdown Creek district, where it forms large masses of the outer edge of the brush. Only a tall shrub or small tree as seen. This species might readily be mistaken for a small-leaved form of *E. Smithii*, which is recorded from the Clarence and New England. I did not meet with the latter species.

MELASTOMACEÆ.

Melastoma malabathricum, Linn. — Not uncommon between Bellinger Heads and Fernmount. A handsome shrub about 4 feet high. It is a matter of surprise to me that it is not oftener seen in gardens. It does not appear to have been previously recorded south of the Clarence.

LYTHRARIEÆ.

Lythrum Salicaria, Linn.—Bellinger River.

ONAGRARIEÆ.

Baron von Mueller reduces all Australian *Epiloblums* to *E. glabellum*, an arrangement which saves botanists a good deal of trouble. Some of the plants vary so much in habit and structure when growing in the same district that if it be expedient to level the species, perhaps it would be well to distinguish varieties. I have carefully examined my plants, and it will be observed that I have placed them under four forms. The locality for *E. junceum* might be noted, while *E. glabellum*, in its restricted sense, is new to the Colony.

Epilobium junceum, Forst.—Bald Hills Station to Guy Fawkes.

Epilobium glabellum, Forst.—Tyringham to Bald Hills Station.

Epilobium tetragonum, Linn.—Bald Hills station to Guy Fawkes.

Epilobium Billardierianum, Ser.—Tyringham to Guy Fawkes.

PASSIFLOREÆ.

Passiflora Herbertiana, Lindl.—Dorrigo Forest Reserve.

UMBELLIFERÆ.

Hydrocotyle asiatica, Linn.— Forms dense carpets in the Dorrigo Forest Reserve, particularly in the large clearings made for cedar planting, in rich, damp soil. [See a note in the *Gazette* for May last, page 306.]

Trachymene australis, Benth. (Syn. *Didiscus pilosus*, Benth.)—Tyringham.

Trachymene incisa, Rudge (Syn. *Didiscus albiflorus*, DC.)—Tyringham to Bald Hills.

Siebera Billardieri, Benth. (Syn. *Trachymene Billardieri*, F. v. M.)—Found on the very summit of the Round Mountain. The locality is interesting.

Xanthosia pilosa, Rudge.—Dorrigo Mountain.

Apium leptophyllum, F. v. M.—Tyringham.

ARALIACEÆ.

Panax Murrayi, F. v. M.—Glenfernie Forest Reserve. Those seen were not more than 35 feet high.

Panax sambucifolius, Sieb.—Normal form. Tyringham to Bald Hills; also in the Dorrigo.

Panax sambucifolius, Sieb. var.—Near the Bald Hills I found a form of this species most resembling the variety which Baron von Mueller at one time looked upon as a distinct species, and called *P. dendroides*. The leaves of my plant only very rarely show any tendency to be pinnatifid, are all more or less serrate, and are with leaflets as narrow, and strongly resembling, specimens from the Snowy Mountains (New South Wales and Victoria).

Panax elegans, F. v. M.—Bellinger River, in the brush land near the ocean.

LORANTHACEÆ.

Loranthus celastroides, Sieb.—On the very summit of the Round Mountain, Guy Fawkes district.

Loranthus dictyophlebus, F. v. M.—Dorrigo Forest Reserve.—I have lost my notes in regard to the host-plants of these two species of *Loranthus*. *L. dictyophlebus* is a most beautiful plant.

Loranthus pendulus, Sieb.—Glenfernie Forest Reserve.

Loranthus pendulus, Sieb., var. *parviflorus*, Benth.—On the prickly-leaved tea-tree (*Melaleuca styphelioides*), Bellinger River.

CAPRIFOLIACEÆ.

Sambucus Gaudichaudiana, DC.—Bald Hills to Guy Fawkes.—An interesting locality, at a high elevation, for this species.

RUBIACEÆ.

Psychotria daphnoides, A. Cunn. (?)—The common *Psychotria* of the Dorrigo and Glenfernie Forest Reserves.—It resembles *P. loniceroides* in the venation of the leaves, and, as regards the narrower-leaved forms, in their shape, in the rusty tomentose peduncles, pedicels, and inflorescence generally. It differs from this species in the thinner and more acuminate leaves. It differs from *P. daphnoides* in the narrow lanceolate leaves, with prominent veins. These leaves are acuminate and narrowed at both ends. This description would include a number of specimens from the Richmond River, but the leaves of plants from the Dorrigo are much longer and narrower, besides differing in other respects. The leaves and young branches are not so softly tomentose as those of *P. loniceroides*. On the other hand, they are not glabrous, like *P. daphnoides*. In fact, I cannot describe them better than by saying that they are intermediate in character between these two species. Baron von Mueller observes (*Fragm.* ii, 135), that the leaves of *P. daphnoides* may be pubescent or tomentose. If, however, the Dorrigo plant is to be put under *P. daphnoides*, the botanical description of that species must be read with a good deal of latitude.

Coprosma hirtella, Labill.—Farmer's Falls, Bald Hills Station, 65 miles east of Armidale, in the crevices of prismatic basalt.—Not to be distinguished from specimens from Bibbenluke, Cooma (Miss Edwards), and from Mount Vincent, on the watershed between the Turon and Capertee Rivers (R. T. Baker). This New England locality in which I found the species is considerably farther north than it has been found before. Between this station (Bald Hills) and Guy Fawkes, I also found a very small-leaved and glabrous form of this species—the leaves all lanceolate, and with a maximum length of $\frac{7}{8}$ inch, and maximum breadth of $\frac{1}{8}$ inch.

Opercularia hispida, Spreng.—Tyringham.

Pomax umbellata, Spreng.—Dorrigo and New England.—Common.

Asperula conferta, Hook. f., var. *elongata*, Benth.—Bald Hills Station to Guy Fawkes and the Round Mountain. On the very summit of the latter.

Galium Gaudichaudi, DC.—Bald Hills to Guy Fawkes.

COMPOSITÆ.

Ageratum conyzoides, Linn. (Syn. *A. mexicanum*, Sims, probably). "Billy Goat Weed."—This garden plant was observed to be dotted all over some paddocks in the neighbourhood of Fernmount. It is undoubtedly spreading. It is a weed in Queensland, see Bailey, *Proc. Linn. Soc. N.S.W.*, iv, 28.

Olearia chrysophylla, Benth.—Not observed on the Dorrigo, but found in the Glenfernie Forest Reserve, at the edge of the forest itself, say 100 feet higher than Glenfernie Creek, thenceforward, usually near the rocky banks of creeks, often amongst prismatic basalt, right upward to Bald Hills, Guy Fawkes, and even to near the top of the Round Mountain (granite). The "Guy Fox Peak," as quoted by Mueller (*Fragm.* ii, 88), and copied by Bentham (*B. Fl.* iii, 468), where the species was collected by Beckler, may be the Round Mountain, or one of the lesser elevations in the vicinity of the Guy Fawkes River. My specimens are all densely woolly (the upper surface of the leaves alone excepted), just like pieces cut out of flannel—those from Glenfernie especially so. A handsome species for cultivation. Like many of the *Olearias*, the new leaves often pink.

Olearia alpicola, F.v.M.—On the sides of the gorge adjoining the Guy Fawkes Falls.—Specimens of this species in my herbarium from the Australian Alps are, as described in the *Flora Australiensis*, with almost silvery indumentum. They are also lanceolate, and far broader than the specimens from Guy Fawkes. My specimens are densely woolly—in fact, as regards the under surface of the leaves, they look as if they have been cut out of a piece of chamois leather. The leaves are linear-lanceolate, from 2 to 4 inches long, the average being 2½ inches. The occurrence of this species so far north is interesting. It has only previously been recorded from the high mountain ranges about the Victoria-New South Wales border.

Olearia rosmarinifolia, Benth.—In the rocky gorge about Farmer's Falls, Bald Hills Station.

Olearia (*Aster*) *oliganthema*, F. v. M.—This apparently very rare species, hitherto only recorded from the Blue Mountains, was collected on the banks of a basalt-bedded creek near Bald Hills Station, New England. *Oliganthema* is a happy name for my specimens, as it was with the greatest difficulty that I could procure flowers, and these are exceedingly sparse.

Olearia myrsinoides, F. v. M. (Syn. *Aster myrsinoides*, Labill.)—Spickett's Creek, Bellinger River, and banks of the Little Murray River, Dorrigo Forest Reserve.—The form with linear-lanceolate, more or less toothed leaves, and smelling sweetly of musk. Very easy to cultivate. These far northern localities are new.

Olearia Nernstii, F. v. M.—Dorrigo Mountain.

Olearia ramulosa, Benth.—On the very summit of the Round Mountain.

Olearia elliptica, DC.—Guy Fawkes to Wollomombi.

Vernonia cinerea, Less.—Bellinger to New England.

Centratherum muticum, Less.—Dorrigo Mountain.

Vittadinia australis, A. Rich., var. *dissecta*, Benth.—Tyringham to Bald Hills.

Erigeron linifolius, Willd.—Bellinger River.

Calotis dentex, R. Br.—Collected from Tyringham to near Guy Fawkes.—These New England forms have comparatively large leaves, and are less divided than the coast form as found in the Sydney district. They are more or less hispid, the plants from the Bald Hills so much so as to be almost woolly.

Lagenophora Billardieri, Cass.—Bellinger and Dorrigo, in grass-land.

Brachycome diversifolia, Fisch. et Mey.—Collected in various places from Bostobrick right onward through Tyringham, Bald Hills, &c., to Guy Fawkes and the Round Mountain. Found on the very summit of the latter.—The name *diversifolia* is well bestowed, specimens (as, for instance, those of Bostobrick), having finely-divided leaves, whereas some from Guy Fawkes are very much less divided, strongly resembling in outline some

forms of *Calotis dentex*. Some are nearly glabrous, while those from Guy Fawkes are scabrous-hirsute throughout. Plants from Tyringham are 2 feet high and more; those from Guy Fawkes and the Round Mountain are rather slender plants, not exceeding 6 or 8 inches high as seen.

Bidens pilosa, Linn.—Bellinger River.

Cotula coronopifolia, Linn.—Bellinger River. Common.

Myriogyne minuta, Less.—Common about the sandy bed and banks of the Bellinger River.

Craspedia Richea, Cass.—Plains of the Dorrigo; also New England.

Ammobium alatum, R. Br.—Bald Hills Station, then a little lower than Guy Fawkes, then about Wollomombi. In low-lying situations, as seen.

Cassinia longifolia, R. Br.—Not rare in the Dorrigo, and particularly common all round the Little Plain, where it forms small trees skirting the brush. This locality appears to be new.

Cassinia longifolia, R. Br., var. *straminea*, Benth.—Abundant in the Dorrigo and Glenfernie Forest Reserves, but particularly so in the former. Usually found at the tops of rather steep banks of creeks, forming a good deal of the "scrub" growth. Involucral bracts golden-coloured, but drying a pale brown. Very ornamental, the stems, particularly of younger shoots, more or less rusty tomentose. The leaves always with a dirty white and creamy tomentum underneath.

Ixiolæna brevicompta, F. v. M.—Plentiful on the Dorrigo Mountain and in the more open spaces of the Dorrigo Forest Reserve. The locality is interesting, as it is only previously recorded from the head of the Gwydir.

Podolepis acuminata, R. Br.—Abundant on the plains of the Dorrigo, and plentiful thenceforward, at least as far as Guy Fawkes. It is well to note Bentham's remark that northern forms of this species have usually smaller flower-heads than the southern ones. The flower-heads of my specimens are, as a rule, scarcely larger than those of *P. longipedata*, to which species *P. acuminata*, in general appearance and botanical characteristics, is undoubtedly very closely allied. The only satisfactory characteristic is to observe that what Baron von Mueller calls the "stalk-like base" of the inner involucral bracts is quite enclosed in *P. acuminata*, and partly exserted in *P. longipedata*. It is also worthy of note that the expression "singly terminal" does not apply to the flower-heads of the northern forms (at least) of *P. acuminata*. On the contrary, the inflorescence is corymbosely branched, the stalks of the indefinite corymb being surmounted by flower-heads in pairs, on rather long pedicels.

Leptorrhynchus squamatus, Less.—Guy Fawkes to Wollomombi.

Helichrysum scorpioides, Labill.—Plentiful about the Bald Hills, Tyringham, and other places in New England.

Helichrysum bracteatum, Willd.—Common in the "plains" of the Dorrigo, thenceforward to Guy Fawkes and the Round Mountain, on the very summit of which it may be seen.

Helichrysum apiculatum, DC.—This species is found in the plains of the Dorrigo and all over New England, ascending to the highest elevations. My specimens include three forms of very different appearance:—1. A broad-leaved very stem-clasping silky or woolly form common in the grass in the Dorrigo. Many of the leaves are 2½ inches long, and $\frac{7}{16}$ inch broad. A handsome plant. 2. At higher elevations, say at the Bald Hills, Grass-tree Knob, &c., the leaves are still silky or woolly, but narrow. This is the variety *minor*, Benth. (B. Fl. iii, 625). 3. Still ascending, we have at the Guy Fawkes River and Falls, and in the elevated country in that district, a third form, with broad leaves like No. 1, but hardly as long or as stem-

clasping. The under surface of the leaf is cottony, but the upper surface is glabrous. The stem is hispid with short hairs, giving it a brown or ferruginous look.

Helichrysum semipapposum, DC.—From near Glenfernie, ascending all the way to Guy Fawkes and the Round Mountain.

Helichrysum obovatum, DC.—In a moist crevice of basaltic rock, half way up the Dorrigo Mountain. Apparently rare.

Helichrysum diosmifolium, Less.—Very abundant at the tops of the rocky banks of the Beilsdown and other creeks in the Dorrigo. The leaves are broader than those of plants I have seen from any other part of the Colony.

Helipterum anthemoides, DC.—Bald Hills to Guy Fawkes.

Helipterum incanum, DC.—Tyringham to near Guy Fawkes.—Abundant.

Gnaphalium luteo-album, Linn.—Tyringham to Guy Fawkes.

Senecio lautus, Forst.—Bald Hills to Guy Fawkes.

Senecio vagus, F. v. M.—Around Beilsdown and other creeks, Dorrigo Forest Reserve.

Senecio australis, Willd, var. *macrodontus*, Benth.—Plentiful about the Bald Hills. Unusually cottony white.

Cymbonotus Lawsonianus, Gaud.—Bellinger and Dorrigo.—In grass-land.

Hypochœris radicata, Linn.—Found on the very summit of the Round Mountain.

Picris hieracioides, Linn.—Plentiful on the Dorrigo and throughout New England, ascending at least as high as Guy Fawkes.

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STYLIDEÆ.

Stylidium graminifolium, Sw.—Bald Hills to Guy Fawkes and the Round Mountain, on the very summit of which it is found.

Stylidium debile, F. v. M.—Bellinger River.

GOODENIACEÆ.

Goodenia bellidifolia, Sm.—Bald Hills to Wollomombi.—Apparently the common *Goodenia* of these parts. At Guy Fawkes it was exceedingly abundant.

Goodenia hederacea, Sm.—Plains of the Dorrigo, right onward to Guy Fawkes and the Round Mountain, on the very summit of which it occurs.

Scævola microcarpa, Cav.—The Bellinger and Dorrigo.

CAMPANULACEÆ.

Lobelia trigonocaulis, F. v. M.—On the steep banks (where there is good moist soil) of Beilsdown, Boggy, and other creeks, Dorrigo Forest Reserve.—I recommend this *Lobelia* to the notice of gardeners.

Lobelia purpurascens, R. Br.—Common on the Bellinger and Dorrigo in damp situations.—Since my return, Mr. R. Williams writes to me from the Bellinger concerning this plant: "The aborigines of this locality aver it to be an effectual cure for snake-bite. They tell me that if an iguana gets bitten in conflict with a snake it scampers off to this plant, and after eating a quantity of it, vomits copiously, and returns to the battle as well as ever." I have received a similar account from Kempsey, and also from Port Macquarie. See my note on the subject in *Proc. Linn. Soc. N.S.W.* [2], v, 279. (1890). Also *Agric. Gazette*, p. 473, for July.

Wahlenbergia gracilis, A.DC.—Plains of the Dorrigo and at higher elevations in New England.

EPACRIDEÆ.

Styphelia viridis, Andr. var., *breviflora*, Benth.—Guy Fawkes to Round Mountain (on the very summit).—It is not likely that Bentham's "northern parts of New South Wales" includes this sub-alpine locality in which I found it.

Trochocarpa laurina, R. Br.—Dorrigo Forest Reserve.—Leaves much smaller than those of the ordinary form. No doubt the plant referred to in the Flora as "Head of Bellinger River, a small and narrow-leaved stunted variety." (C. Moore). Some of the plants I saw were slender trees, say 15 feet high.

Brachyloma daphnoides, Benth.—Guy Fawkes and the Round Mountain.

Lissanthe strigosa, R. Br.—On the very summit of the Round Mountain. The locality is worthy of note.

Leucopogon lanceolatus, R. Br.—Forms part of the undergrowth, particularly at the edges of the brush, Dorrigo Forest Reserve. Thenceforward as far as Guy Fawkes and the Round Mountain (on the very summit), but in those sub-alpine localities the leaves are a little smaller and more rigid.

Acrotriche aggregata, R. Br.—Not rare at the edge of the brush, Dorrigo Forest Reserve. A straggling bush or very small tree, 6 to 8 or 10 feet high.

Monotoca scoparia, R. Br.—The Dorrigo to Tyringham; thence right onward to Guy Fawkes and the Round Mountain, on the very summit of which it is found.

Epacris paludosa, R. Br.—Guy Fawkes and Round Mountain (summit).—This locality is interesting, as it has not previously been recorded from a locality nearer than the Blue Mountains.

Epacris heteronema, Labill, var. (?) *planifolia*, Benth.—A stunted shrub of 3 or 4 feet high, by the side of ditches or small creeks near Bald Hills Station, New England. This plant corresponds exactly to Bentham's description of the variety mentioned. For some time I passed over *E. heteronema*, because of the slightly ciliate bracts and sepals. Its present locality is interesting, as its previous New South Wales localities are Blue Mountains and south of Bathurst.

Epacris microphylla, R. Br.—Guy Fawkes and the Round Mountain.—Abundant.

MYRSINEÆ.

Myrsine variabilis, R. Br.—A small tree, usually skirting the tops of gullies. Glenfernie Forest Reserve.—I did not notice it in the Dorrigo, though no doubt it is there.

Ægiceras majus, Gærtn.—Mangrove swamps near Bellinger Heads. I am informed that this mangrove is found as far up the Bellinger as Raleigh, and up the Nambucca as far as Macksville.

SAPOTACEÆ.

Achras australis, R. Br. "Black Apple."—Dorrigo Mountain, Dorrigo Forest Reserve, Glenfernie Forest Reserve, also in the brushes near the coast.—Very abundant.

STYRACEÆ.

Symplocos Thwaitesii, F.v.M.—A small tree, Bellinger River, towards base of Dorrigo Mountain.

JASMINEÆ.

Olea paniculata, R. Br. "Marble-wood."—Some trees of this species noticed in the Dorrigo. The meaning of the term marble-wood is not

apparent. I am informed it is because the wood is hard like marble chippy. It certainly has no reference to the grain of the timber.

Notelæa longifolia, Vent.—On the very summit of the Round Mount The locality is worthy of note. Found also in the brushes near the coas

APOCYNEÆ.

Tabernæmontana orientalis, R. Br., var. *angustisepala*, Benth.—Glenfe Forest Reserve.—Small tree; habit of *Hymenosporum flavum;* flowers w and deliciously scented. Found also on the Bellinger River, near the He

ASCLEPIADEÆ.

Hoya australis, R. Br.—With exceptionally long petioles and large lea pale green on the under side. Bellinger River, near the ocean.

LOGANIACEÆ.

Mitrasacme polymorpha, R. Br.—Bellinger River.

GENTIANEÆ.

Erythræa australis, R. Br.—Throughout the journey.

BORAGINEÆ.

Myosotis australis, R. Br.—Bald Hills to Guy Fawkes.
Cynoglossum australe, R. Br.—Bald Hills to Guy Fawkes.

CONVOLVULACEÆ.

Convolvulus erubescens, Sims,—Plains of the Dorrigo.

SOLANEÆ.

In the Bellinger, on the Dorrigo Mountain, and in the Dorrigo and G fernie Forest Reserves, *Solanums* grow in the greatest profusion. T seem to spring up everywhere where the indigenous vegetation has b disturbed or cleared. In the Dorrigo itself, where clearings have b made, the ground, if neglected, is overrun with arboreal *Solanums*, presen the appearance of peach orchards at a little distance. *Solanums* canno many instances, be satisfactorily determined in the absence of fruits, collectors, in such rich districts for this genus, should immerse the fruit preservative liquids as they proceed, carefully noting the colours the fruits at the time. Unfortunately some of my fruits were destroye transit *viâ* the Bellinger. I believe the district will reward the bota with material of imperfectly described species, and it is exceedingly unlil that there are no new species remaining to be discovered in the pl indicated.

Solanum vescum, F. v. M.—Dorrigo Forest Reserve.—Not rare.

Solanum aviculare, Forst.—Dorrigo Mountain, Dorrigo, and Glenfe Forest Reserves.—Growing to the size of a small tree, and overrun cedar-clearings, giving them the appearance, at a little distance, of pe orchards.

Solanum stelligerum, Sm.—Dorrigo Mountain, Dorrigo and Glenfe Forest Reserves.

Solanum sporodotrichum, F. v. M.—Dorrigo Forest Reserve.—Not r The fruit of this species was hitherto unknown, and although my specim are hardly ripe, it may be mentioned that they are dark purple, ovoid, only $\frac{3}{8}$ of an inch in greatest length.

Solanum densevestitum, F. v. M.—Glenfernie Forest Reserve.

Solanum semiarmatum, F. v. M.—Dorrigo Mountain, Dorrigo and Glenfernie Forest Reserves.

Solanum campanulatum, R. Br.—Dorrigo Mountain, Dorrigo and Glenfernie Forest Reserves.

Solanum cinereum, R. Br.—Glenfernie Forest Reserve.—Not previously recorded from nearer than the Gwydir River.

Solanum ellipticum, R. Br.—Bellinger River.—This plant seems to be more frequently met with in "interior" localities.

Nicandra physaloides, Gærtn.—On the sides of the Dorrigo Mountain, on newly-exposed earth, forming the slopes below the Government road.—A South American plant.

Physalis peruviana, Linn. "Cape Gooseberry."—Particularly abundant on the Bellinger, where it has thoroughly established itself in the rich brush lands.

Duboisia myoporoides, R. Br. A "Corkwood."—Small trees or tall shrubs, chiefly at the edges of the brush land, Little Plains, and other places in the Dorrigo. Not rare.

SCROPHULARINEÆ.

Gratiola peruviana, Linn.—The Bellinger, Dorrigo, and various places in New England.

Veronica Derwentia, Andr.—Bald Hills to Guy Fawkes and the Round Mountain (on the very summit), chiefly in rocky country, near water-courses; very abundant, yet it would not appear to have been previously recorded from New England.

Euphrasia collina, R. Br. (Syn. *E. Brownii*, F. v. M.)—In swampy land about Guy Fawkes, and nearly at the top of the Round Mountain.

Euphrasia scabra, R. Br.—Bald Hills to Guy Fawkes. Very abundant in grass-land near the Guy Fawkes Falls.

ACANTHACEÆ.

Ruellia australis, R. Br.—Bellinger River.

Eranthemum variabile, R. Br.—Bellinger River.—Common. Since my return to Sydney, Mr. W. A. B. Greaves has shown me this plant under cultivation as an edging, like *Lobelia*, and very pretty it looks.

BIGNONIACEÆ.

Tecoma australis, R. Br.—Bellinger and Dorrigo.

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MYOPORINEÆ.

Myoporum acuminatum, R. Br.—Bellinger River.

VERBENACEÆ.

Lantana Camara, Linn.—This pest is very abundant on the Bellinger, and particularly so about Fernmount. The main roads from Bellinger to the Heads, on both sides of the river, and also the adjoining lands, are covered with it. It is chiefly spread through the agency of birds, who eat the fruits. Fortunately it may be readily rooted up, and farmers and others would do well to wage incessant war against it. It should not be tolerated, not even to cover unsightly objects, as we have no lack of plants suitable for such purposes, and which are not likely to injure one's own or one's neighbour's land.

Verbena officinalis, Linn.—Skirts of Glenfernie Forest Reserve.

Clerodendron tomentosum, R. Br.—Bellinger River.

Gmelina Leichhardtii, F. v. M. "White Beech."—Apparently there are perhaps only half-a-dozen trees of this valuable timber tree in the Dorrigo. This is important, as I was under the impression (and I know a number of other people were), that the reserve contained a good deal of this beech. It is very scarce throughout the Bellinger district.

LABIATÆ.

Plectanthrus parviflorus, Willd.—Glenfernie Forest Reserve.

Mentha gracilis, R. Br. (?)—Bald Hills Station.—It is not easy to distinguish between some forms of *M. gracilis* and *M. satureioides*. If I were to consider the localities for the latter species as given in the Flora, I find that Beckler and Clarendon Stuart collected it in New England, while *M. gracilis* is usually found in the south-east of this Colony, but I cannot at all call the calyx of my plant "always densely villous inside with white hairs, readily distinguishing this species (*M. satureoides*) from all others." On the contrary, the calyx of my plant is "not very hairy inside," and inasmuch as I cannot find any other character (not even the shape of the calyx-teeth) to distinguish my plant from *M. gracilis*, I cannot put it under *M. satureioides*, philosophically and broadly as I am always willing to read plant descriptions. I cannot help expressing the opinion that our Australian *Menthas* want revising.

Prunella vulgaris, Linn.—Plains of the Dorrigo.—I collected a specimen, with yellowish flowers, which is, as far as I am aware, a very unusual circumstance.

Prostanthera lasianthos, Labill.—Very abundant on the banks of the Beilsdown and other creeks, Dorrigo Forest Reserve.—It was with the greatest difficulty that I could detect any trace of serration on the leaves; an odd leaf, here and there, shows a little of it. In fact, this form might with reason be called *integrifolia*.

Prostantheria phylicifolia, F. v. M.—Guy Fawkes to Round Mountain.—Recorded already from "New England," though probably not from such an elevated locality as the Round Mountain.

Westringia glabra, R. Br.—Guy Fawkes to Wollomombi.

Ajuga australis, R. Br.—Guy Fawkes and Round Mountain.

CHENOPODIACEÆ.

Rhagodia hastata, R. Br.—About Bostobrick; also Dorrigo Forest Reserve.

POLYGONACEÆ.

Polygonum subsessile, R. Br. "Smart grass," a name it shares with *P. lapathifolium*.—Tyringham to near Guy Fawkes.—Spreading every year.

Polygonum lapathifolium, Linn.—Bellinger, Dorrigo, and throughout New England.—I am assured by local residents that this plant is spreading.

MONIMIACEÆ.

Doryphora Sassafras, Endl.—"Sassafras" (sometimes also called "Yellow Wood")—Bellinger River, and Dorrigo Forest Reserve.

Daphnandra micrantha, Benth. "Sassafras" or "Yellow Wood."—Yellow-wood is hard to eradicate, as it springs up again from fragments of root, which may be left in the soil. Banks of Bellinger River, Dorrigo, and Glenfernie Forest Reserves. Abundant.

Kibara macrophylla, Benth. (*Mollinedia macrophylla*, Tul.)—Bostobrick.—Quite a small tree, and not common.

Hedycarya angustifolia, A. Cunn.—On the skirts of the brush, Dorrigo Forest Reserve.—Not common.

Piptocalyx Moorei, Oliv.—This imperfectly known plant was not collected by me on the trip, although it extends up to a few miles from my route. I, however, obtained it from a correspondent whose acquaintance I made on this trip. Endeavours have been made to introduce its leaves in Europe for brewing. A number of interesting particulars connected with this plant have been recounted by me in the *Agricultural Gazette* for August, to which I beg to refer my readers.

LAURINEÆ.

Cryptocarya obovata, R. Br.—Glenfernie Forest Reserve.—Apparently not common.

Cryptocarya glaucescens, R.Br., var. *reticulata*, Meissn.—Glenfernie Forest Reserve.

Cryptocarya Meissneri, F. v. M.—Dorrigo Forest Reserve.—Common. Found principally in damp ground sloping to creeks. Perhaps the commonest small tree on the Dorrigo. It seemed to be everywhere.

Endiandra Muelleri, Meissn.—Glenfernie Forest Reserve.—The nearest locality already recorded is a doubtful specimen from the Bellinger River. (B. Fl. v, 302).

Litsæa dealbata, Nees.—On the skirts of the brush, Dorrigo Forest Reserve.—Rather common in places.

Cassytha pubescens, R. Br.—Dorrigo Forest Reserve.

PROTEACEÆ.

Petrophila sessilis, Sieb.—Guy Fawkes and Round Mountain.—Recorded already from "New England," but this definite sub-Alpine locality is worthy of note.

Persoonia media, R. Br.—With rather small leaves. Guy Fawkes to Round Mountain. Closely allied, undoubtedly, to *P. lanceolata*, but my plant cautiously separated from it by the ferruginous pubescent young branches, the almost elliptical young leaves, which are sometimes oblique and slightly falcate; the pedicels larger than those of *P. lanceolata.* The ovary is not perfectly glabrous, but the hairs are almost disappearing. The very elevated New England locality for this species is interesting; it has previously been recorded from the Hastings and Clarence by Beckler.

Persoonia corniflora, A. Cunn.—Tyringham, right through New England to Guy Fawkes and Round Mountain (on the very summit), and lower down on the other side at least as far as Wollomombi.

Persoonia prostrata, R. Br. Guy Fawkes and Round Mountain.—Forming prostrate masses of pale green vegetation.

Persoonia lucida, R. Br., var. *latifolia*, Benth.—The most widely-diffused *Persoonia* collected by me. Found in the Dorrigo Forest Reserve, (at Spickett's Camp there is a tree 2 feet in diameter!), at Bostobrick, Tyringham, right onward through Bald Hills and Guy Fawkes to Wollomombi. I have not both fruits and flowers of all the specimens; this has caused me to give the specimens the most searching examination, with the result indicated.

Macadamia Youngiana, F. v. M. (syn. *Helicia Youngiana*, F. v. M.)—Dorrigo Forest Reserve.—Very abundant, particularly towards the head of Beilsdown Creek. It forms, in parts of the reserve, a large proportion of the shrubby undergrowth, sometimes to the exclusion of almost every other tall

shrub. Its white flowers exhale a delicious perfume. Nearest previou recorded locality, Clarence River.

Macadamia ternifolia, F. v. M.—The "Queensland Nut" does not exten far south as the Dorrigo.

Orites excelsa, R. Br. A "Silky Oak."—Height, 60 to 100 feet. Diame 1 to 3 feet. Perhaps the commonest large tree in the whole of the rese Almost the whole of my specimens have undivided leaves. A few are h and there toothed. In the *Flora Australiensis* the length of the leave given at from 4 to 6 inches, but the average of my specimens is m smaller, being under 4 inches. I have also the variety *fissifolia*, F. v (*Fragm.* v. 153), with trifid or pinnatifid leaves. I got it in that part of Dorrigo Forest Reserve between Boggy Creek and the Little Murray Ri but it is by no means rare, and is probably diffused throughout the dist I can best describe the timber of *Orites excelsa* by saying that at presen do not know in what respect it differs from that of *Grevillea robusta*, true "Silky Oak." As that valuable timber is now comparatively scarc believe that *Orites excelsa* will prove in every respect an efficient substi for it, and the quantity of mature timber available in the Dorrigo at present time will probably be sufficient for the Colony's needs for m years to come, without making any allowance for the natural reproduc of the plant.

Hakea eriantha, R. Br., (small-leaved form).—From the banks of Bli River at Tyringham, right on nearly to Guy Fawkes, in swampy situation None of my specimens have leaves as much as 3 inches long. The lar would be 2½ inches, and the average much less. They are also narro than I have seen them from any other locality. The leaves are thick very rigid, being quite pugioniform. The midrib, perhaps, also can ha be called scarcely prominent.

Hakea microcarpa, R. Br.—Bald Hills, thence to Guy Fawkes and W mombi.—The specimens from the latter localities have leaves thicker more rigid than those from the former localities.

Hakea dactyloides, Cav.—Guy Fawkes and Round Mountain (on the summit).—A very narrow-leaved form, apparently similar to those refe to by Bentham as having been collected by C. Stuart.

Lomatia ilicifolia, R. Br., and *L. Fraseri*, R. Br.—In the *Flora A tralienis* (v, 536) these two species are combined by Bentham under name of *L. ilicifolia*, although he evidently had widely diverse forms be him.

1. *L. ilicifolia.*—The southern forms of the species, with their mark reticulate venation, almost glabrous leaves, except the ferruginous pubesc along the underside of the midrib, and a mere sprinkling of hairs over leaf, and their long-stalked terminal inflorescence, seem sufficiently diffe from a typical specimen of *L. Fraseri.*

2. *L. Fraseri.*—I have *L. Fraseri* from various localities between B down Creek (Dorrigo Forest Reserve) up to the Guy Fawkes and the Ro Mountain (over 5,000 feet), in the Snowy Range, New England, makin range of over 2,000 feet in this particular direction. Plants of this dist are, as Bentham points out, generally more ferruginous-pubescent than southern ones.

3. I also collected at Beilsdown Creek specimens intermediate in chara between the typical *L. ilicifolia* and *L. Fraseri.* For instance, the le are more narrow lanceolate, approaching the usual shape of those of southern forms of *L. ilicifolia*; more pungently serrate than *L. Fras* have hardly any of the silky vestiture of the latter species, except on

young shoots; the inflorescence is, however, as pubescent as that of *L. Fraseri* usually is. Laying them all out on a table for comparison, I have no hesitation in looking upon this plant as partaking of the characters of both *L. ilicifolia* and *L. Fraseri* as usually defined, and I have had so much difficulty in assigning it to either, that I feel sure that specimens such as these helped Bentham to decide that *L. ilicifolia* and *L. Fraseri* are but extreme forms of the same species. At the same time I follow Mueller, who revives Robert Brown's *L. Fraseri*, and put my specimen as a variety of that species, principally on account of its axillary and hirsute inflorescence.

Lomatia Fraseri, R. Br., var. *pinnatipartita*, F. v. M.—Bald Hills to Guy Fawkes, and thenceforward to the Round Mountain.—A beautiful foliage plant, well worthy of cultivation in the colder parts of the Colony. The plants from the Round Mountain and Guy Fawkes have leaves less pinnatisect than those from the less elevated Bald Hills. Collected at the Guy Fawkes River by Beckler (*Fragm.* v, 153).

Lomatia silaifolia, R. Br.—Guy Fawkes and Round Mountain (on the very summit).—This form cannot be distinguished from specimens from the summits of the Blue Mountains (Mount Victoria, for instance). The Port Jackson forms are perfectly glabrous; the Round Mountain and the Blue Mountain forms are slightly hoary underneath the leaves, while the segments are larger.

Stenocarpus salignus, R. Br., "Beefwood."—Occurs in the Dorrigo sparingly.

Banksia collina, R. Br.—Guy Fawkes and Round Mountain.—I only found this species in this one limited district. It ascended as far as the very top of the Round Mountain.

Banksia integrifolia, Linn. f.—Up to 3 and even 4 feet in diameter. Exceedingly common, and the only honeysuckle I could find in the Dorrigo district. It extends all over New England, and it was not until I got on top of the Round Mountain (Guy Fawkes) that I found a second honeysuckle, viz., the dwarf-growing *B. collina*.

Volume VI.

THYMELACEÆ.

Pimelea linifolia, Sm.—Very abundant in the plains of the Dorrigo, and in grass-land throughout New England.

Pimelea ligustrina, Labill, var. *hypericina*, Benth.—Dorrigo Forest Reserve.—Nearest previously recorded localities, Hastings and Clarence Rivers.

Pimelea pauciflora, R. Br.—Dorrigo Mountain, Perrett's Pinch, and Glenfernie Forest Reserve.—A very slender, yet erect growing, and bushy shrub about 6 feet high. Flowers small and yellow, but not showy.

Pimelea curviflora, R. Br., and var. *sericea*, Benth.—Bald Hills Station to Guy Fawkes.

Wikstrœmia indica, C.A. Mey.—Bellinger River.

EUPHORBIACEÆ.

Poranthera microphylla, Brongn.—Plains of the Dorrigo, right on to Guy Fawkes and the Round Mountain, on the very summit of which it is found.

Phyllanthus thymoides, Sieb.—Dorrigo to Tyringham.

Croton insularis, Baill.—Bellinger River.

Croton verreauxii, Baill.—Banks of a creek near Bellingen.—Some specimens in bud from the Dorrigo Forest Reserve, I also tentatively refer to this species.

Baloghia lucida, Endl. "Brush Bloodwood."—Occurs to a limited extent on the Bellinger.

Carumbium (*Omalanthus*) *populifolium*, Reinw.—Bellinger River.—With reference to the note in the *Flora Australiensis*, I hardly think the reddish tint of the young shoots is as noticeable as that of some of the leaves. Usually two or three leaves (but often one, and never less than one), are of a bright red colour, and show a striking contrast to the remaining green foliage.

URTICEÆ.

Trema aspera, Blume.—Bellinger, Dorrigo Mountain, and Dorrigo Forest Reserve.

Aphananthe philippinensis, Planch. "Elm."—Dorrigo Forest Reserve.—Apparently uncommon.

Ficus rubiginosa, Desf. (?) "Strangling or Tyrant Fig."—There is little or no *Ficus*, except at one end of the reserve towards the junction of Beilsdown Creek with the Nymboida. This well-known tree is also found on the Bellinger. It has a small green fruit, the size of a cherry. The above is from notes only, for I have lost my specimens.

Ficus aspera, Forst. "Sand-paper Fig."

Ficus Bellingeri, C. Moore, often mistaken for the true "Moreton Bay Fig" (*F. macrophylla*).—Both these figs are found on the Bellinger.

Cudrania javanensis, Trécul. "Cockspur Thorn."—Dorrigo and Glenfernie Forest Reserves; also through the brushes on the Bellinger and near the coast.

Pseudomorus Brunoniana, Bur.—Bellinger River.

Elatostemma stipitatum, Wedd.—Moist places on the side of the Dorrigo Mountain. In the greatest abundance, hanging down under the waterfalls on Beilsdown, Boggy, and other creeks in the Dorrigo Forest Reserve.

Laportea gigas, Wedd., and *L. photiniphylla*, Wedd.—The large and small leaved nettle trees. Bellinger River and Dorrigo Forest Reserve.—Mr. Mecham informed me that he put the tape round one of these nettle trees on the Dorrigo. At a height of 6 feet from the ground the girth was 59 feet. As a general rule cedar was to be found where this tree grew.

CASUARINEÆ.

Casuarina glauca, Sieb. "Swamp Oak."—A good deal of this oak on the Bellinger.

Casuarina suberosa, Otto et Dietr.—This is the common oak, extending from the coast, in the plains of the Dorrigo, and throughout New England. Found on the very summit of the Round Mountain. It is, in the districts stated, universally known as "Forest Oak." I found a few trees of the forest oak (*C. torulosa*) of the Sydney district on the Bellinger River, and up the Dorrigo Mountain, but I failed to notice it on the Dorrigo or in New England. Both species are used locally for shingles.

C. suberosa and *Frenela rhomboidea* are very numerously dotted over the grass-land of the so-called "plains" of the Dorrigo.

PIPERACEÆ.

Peperomia reflexa, A. Dietr.—Dorrigo Forest Reserve.

CUPULIFERÆ.

Fagus Moorei, F.v.M.—"True or Negro-head Beech" of New South Wales, the latter name being given owing to the rich dark colour of the foliage. Sometimes called "Mountain Beech." It was found by Mr. Carron and Mr. W. A. B. Greaves in 1865, and Mr. Charles Moore, desiring to commemorate Mr. Carron in regard to it, called it *Fagus Carroni*. Baron von Mueller, however, described it under the name of *F. Moorei*. Ascending the Dorrigo Mountain from the Bellinger, the first *Fagus* trees to be seen are on the banks of Rocky Creek. They are here of a height of 100 feet, and a diameter of 2 or 3 feet and more. When we are thoroughly in the Dorrigo, commencing at Beilsdown Creek, the *Fagus* is in the greatest luxuriance. It is found following the course of all the creeks, often it skirts the edge of the brush, but it is also found a considerable distance in the forest. It would be difficult to estimate the number of *Fagus* trees in the Dorrigo, but it must be enormous. From the Dorrigo it extends westerly and south-westerly as far as Bald Hills Station, at the back of Guy Fawkes, where it is present in large quantity in the gullies. This, I believe, is its most western locality, passing south to the county boundary of counties Dudley and Clark, and the western slopes of Mount Kippara, in the Macleay district. I am informed that it is also found in the rough country in the north-west of the county of Gloucester. This must remain its most southern locality, as far as our knowledge goes at present. Its most northern locality would be on the Tooloom Run, on the main Clarence River, where Mr. Greaves has recently found it. It would appear that *Fagus Moorei* rarely descends much below 3,000 feet. It is worthy of note that cedar and *Fagus* do not grow together. The *Fagus* is the hardest timber of the brush, and it is also very heavy. These two characteristics are against its extensive use in the sparsely-settled localities in which it grows. It often grows in practically inaccessible localities. There is no doubt that it is a most durable timber. I cut into logs which had evidently lain by the side of creeks for very many years, and they were damp and moss-grown, but they were perfectly sound. I would look upon it as a valuable timber for culverts and such situations, where it is liable to wet, and I trust that the proper authorities will give it a fair trial. It is red when freshly cut, and dries to a pinkish colour. Very many trees were 5 feet and more in diameter, but they are usually unsound when they are more than 3 feet in diameter. Large trees throw out burrs, from which depend aerial roots. The timber of these burrs often yields a beautiful figure. I would point out that the "myrtle of Tasmania" (*Fagus Cunninghamii*) is a highly-esteemed timber. The bark of our *Fagus* is rough and porous, and because of the moisture-laden situations in which it grows, the bark is often loaded with ferns, orchids, mosses, and lichens. No tree in the brush surpasses it in the quantity of epiphytal vegetation it supports. Many of the trees are bent and gnarled. The very dark green foliage is striking, and the shape and habit of the leaves is handsome. Altogether, it is one of the most interesting of our forest trees. As to the common name of *Fagus Moorei*, we cannot expect the namo of Beech or Colonial Beech to be exclusively appropriated to it, for thousands of people in New South Wales and Queensland regularly employ those terms when speaking of the wood of *Gmelina Leichhardtii*. Beech will, therefore, remain a name for *Gmelina* till the last

stick of it is cut out, so we had better make the best of things, and, by way of distinction, call our *Fagus* "True or Negro-head Beech."

SANTALACEÆ.

Choretrum lateriflorum, R. Br.—Guy Fawkes and Round Mountain.—This elevated locality is worthy of note.

Exocarpus stricta, R. Br.—Dorrigo Forest Reserve.

CONIFERÆ.

Frenela rhomboidea, Endl. (Syn. *Callitris cupressiformis*, Vent.)—This is the only *Frenela* I saw from the Bellinger to New England. On the plains of the Dorrigo it is abundant, growing singly, or in small clumps, in the grass-land, like specimen trees in a gentleman's park. The timber is not used for any purpose.

Araucaria Cunninghamii, Ait. "Colonial or Hoop Pine."—As one approaches the top of the Dorrigo Mountain, the first tree (some 50 feet high), of this species is seen. Then near Rocky Creek the tree attains a far larger size. On the Dorrigo the *Araucarias* seemed mostly to follow the course of the creeks, but there were many trees on the ridges, and the timber from these is far better than those in lower situations. There must be a very large quantity of this timber on the Dorrigo, but only an occasional tree is utilised, owing to the distance from markets. The Glenfernie Forest Reserve contains a large quantity of pine, and there is a mill in the reserve which cuts it up for the Armidale market. This is the most southern locality at which it is commercially worked.

ORCHIDEÆ.

The Dorrigo Forest Reserve was described to me as so rich in orchids that I was disappointed to find very few remaining in bloom at the time of my visit. From examination of the plants, it seemed that the wealth of these plants lay rather in the number of individuals than in the variety of species. At the same time, I think the district would repay a careful search (say) in the month of September. The epiphytal orchids I found were chiefly on the bark of *Fagus Moorei*. The bark of this tree is somewhat corky, and the tree itself is always found in moist localities.

Liparis cælogynoides, F. v. M.—On a corkwood (*Ackama Muelleri*) in a gully at the edge of the Glenfernie Forest Reserve. Previously only recorded from the Clarence River.

Dendrobium speciosum, Sm.—In the Dorrigo and Glenfernie Forest Reserves this orchid grows on trees, and is known as the "Wood-lily." In the Sydney district it grows on rocks, and is hence known as "Rock-lily."

Dendrobium pugioniforme, A. Cunn.—One of the commonest orchids in Dorrigo, hanging down in masses from several kinds of trees, but particularly *Fagus*.

Dendrobium Mortii, F. v. M.—Glenfernie Forest Reserve, on *Fagus* trees.—This orchid has leaves up to nearly 3 inches long, but the average length is less than 2 inches. It is not the typical form of *D. Mortii*, and appears to me to very well answer the description of that form of it which Bentham called *D. Bowmanni* (B. Fl. vi, 286).

Bulbophyllum exiguum, F. v. M.—Dorrigo and Glenfernie Forest Reserves.

Sarcochilus Hillii, F. v. M.—Bellinger River, on *Backhousia myrtifolia*

Cymbidium suave, R. Br.—Bellinger River.

Calanthe veratrifolia, R. Br.—Locally known as "November Lily," because it flowers in that month. Very abundant in the rich brush-land towards the mouth of the Bellinger.

Galeola Ledgerii, F. v. M.—On a blue gum (*Eucalyptus saligna*), on the banks of the Bellinger, opposite Bellingen. A magnificent plant which completely encircled the butt of a tree 2 feet 6 inches in diameter for 3 feet of its length, and which displayed hundreds of flowers. This was in December. Mr. Fitzgerald records its flowering season as November.

Cryptostylis longifolia, R. Br.—Bellinger River.

Microtis porrifolia, Spreng.—Dorrigo Forest Reserve and Bald Hills.

IRIDEÆ.

Patersonia sericea, R. Br.—On the very summit of the Round Mountain.

Libertia paniculata, Spreng. (Syn. *Sisyrinchium paniculatum*, R. Br.)—Dorrigo Forest Reserve, and New England generally.

AMARYLLIDEÆ.

Hypoxis hygrometrica, Labill. — Dorrigo and New England.—Very abundant.

DIOSCORIDEÆ.

Dioscorea transversa, R. Br.—Bellinger River.

Petermannia cirrosa, F. v. M.—Dorrigo and Glenfernie Forest Reserves.—Has the habit of *Eustrephus Brownii*, or *Geitonoplesium cymosum*, and climbs up to nearly the tops of the tall shrubs at the very edge of the brush. It can hardly be called rare. Previously only recorded from Cloud's Creek, Clarence River, where it was collected by Beckler. First described by Mueller (*Fragm.* ii, 93). Again diffidently described by Bentham (B. Fl. vi, 462) from imperfect material. My material, more abundant than that before Mueller or Bentham, enables me to confirm the accuracy of the description in *Fragm.* ii, 93. I have no doubt that the plant has been passed over by collectors as *Eustrephus Brownii.*

Volume VII.

LILIACEÆ.

Smilax australis, R. Br.—Bald Hills to Guy Fawkes and the Round Mountain.

Rhipogonum discolor, F. v. M.—Dorrigo and Glenfernie Forest Reserves.—This prickly climber is particularly abundant on the top of the Dorrigo Mountain, making locomotion difficult.

Dianella lævis, R. Br.—Dorrigo Forest Reserve, right on to Guy Fawkes and the Round Mountain.—This sub-alpine locality is perhaps worthy of record.

Dianella cærulea, Sims.—Dorrigo Forest Reserve, right on to Guy Fawkes and the Round Mountain, on the very summit of which it was collected.

Eustrephus latifolius, R. Br.—Bellinger River.

Geitonoplesium cymosum, A. Cunn.—Bellinger River, also Dorrigo and Glenfernie Forest Reserves.

Kreysigia multiflora, Reichb.—Dorrigo Forest Reserve, at edges of the brush, forming patches about a foot high.

Thysanotus junceus, R. Br.—Bellinger River, and throughout New England. Collected on the very summit of the Round Mountain.

Caesia vittata, R. Br.—Bald Hills to Guy Fawkes.

Arthropodium paniculatum, R. Br.—Tyringham to Bald Hills.

Xerotes longifolia, R. Br.—Found throughout the trip. Extends to the very summit of the Round Mountain.

Xerotes multiflora, R. Br. (Syn. *X. Brownei*, F. v. M.)—Bellinger and Dorrigo.

Xerotes filiformis, R. Br.—Bellinger and Dorrigo.

Xanthorrhœa arborea, R. Br. (?) (Syn. *X. resinosa*, Pers.)—I did not notice a *Xanthorrhœa* until a place called (on account of them) Grass-tree Knob was reached. This place is a pretty, grassy knoll, on the Grafton-Armidale Road, a few miles south of Tyringham. I notice in the county map a grass-tree "nob," a few miles west of the one I mention; presumably there are grass-trees there also. The grass-trees are in a group of about twenty. A little further on I saw a few more, but these were the only ones noticed. They are the largest grass-trees I have ever seen, being up to over 20 feet in height, with a trunk-diameter of 18 inches and more. Mr. Forester Mecham assured me that although he had frequently passed them during the past eleven years, he had never seen a flower-spike on them. There was no sign of a spike at the time of my visit, so I cannot be certain of the species, but I believe it to be *arborea*. The locality is worthy of record, as *Xanthorrhœa* has not, to my knowledge, been previously recorded from the district.

XYRIDEÆ.

Xyris operculata, Labill.—Guy Fawkes and Round Mountain.—Exceedingly abundant in the swamps at these high elevations.

COMMELYNACEÆ.

Pollia crispata, Benth.—Dorrigo Forest Reserve.—Often called red cedar weed, owing to its frequent occurrence in red cedar localities.

JUNCEÆ.

Luzula campestris, D C.—Bellinger River and Dorrigo Forest Reserve.

Juncus planifolius, R. Br.—An unusually narrow-leaved form. Sides of the Beilsdown Creek and other places in the Dorrigo.

Juncus communis, E. Mey.—Very common in the Dorrigo, and, in fact, in New England generally.

Juncus prismatocarpus, R. Br.—Dorrigo Forest Reserve.

PALMÆ.

Calamus Muellerii, Wendl. et Drude. "Lawyer Palm"—Top of Dorrigo Mountain; also in Dorrigo and Glenfernie Forest Reserves. On the Dorrigo it is plentiful in the brushes from the top of the Dividing Range to Beilsdown Creek, but west of that creek there is none.—This plant has not hitherto been recorded, so far as I am aware, from further south than the Clarence River. I have seen very good clothes-lines made from the stems by the settlers.

Kentia monostachya, F. v. M. "Walking-stick Palm."—In various sizes, 5 to 10 feet high, along watercourses and creeks in the mountain brush forests, both Dorrigo and Glenfernie. Particularly abundant near Rocky Creek, at the top of the Dorrigo Mountain. Found also in most of the scrubs on the coast and on the Orara. Mr. Mecham informs me that on Pine Creek, between Raleigh and Coff's Harbour some of the brushes are a mass of these palms; they grow there to a height of 20 feet.

Ptychosperma Cunninghamii, Wendl., "Bangalow Palm."—Grows in most of the brushes near the coast. Very plentiful on Spickett's Creek, between Bellingen and Bowraville, where it grows to a great height; also plentiful between Coff's Harbour and Raleigh.

AROIDEÆ.

Colocasia macrorrhiza, Schott. "Cunjevoi."—Plentiful on the Bellinger.

Gymnostachys anceps, R. Br.—Dorrigo and Glenfernie Forest Reserves.

Pothos Loureiri, Hook et Arn.—Dorrigo and Glenfernie Forest Reserves, forming leafy girdles on the brush trees. Very abundant and very ornamental.

ERIOCAULEÆ.

Eriocaulon Smithii, R. Br.—Tyringham to Bald Hills.

RESTIACEÆ.

Restio gracilis, R. Br.—Guy Fawkes and the Round Mountain.—In swampy land, nearly on the top of the Round Mountain, this plant was found in enormous quantities, the reddish-brown male inflorescence being of a very ornamental character.

CYPERACEÆ.

Cyperus tetraphyllus, R. Br.—Dorrigo Forest Reserve.

Cyperus Gunnii, Hook. f.—Guy Fawkes to Wollomombi.

Scirpus polystachyus, F. v. M.—In crevices of the rocky bed of Beilsdown Creek, in patches of damp earth.—Nearest previously recorded localities, Clarence River and Mount Mitchell. A handsome species.

Scirpus riparius, Spreng.—Edges of Beilsdown Creek, Dorrigo Forest Reserve.—Not previously recorded north of Port Jackson.

Scirpus inundatus, Spreng.—Dorrigo Forest Reserve.

Scirpus mucronatus, Linn.—Creek within the township of Bellingen.

Schœnus Brownii, Hook. f.—Dorrigo Forest Reserve and New England.—Very abundant.

Mesomelæna deusta, Benth. (Syn. *Carpha deusta*, R. Br.)—Dorrigo Forest Reserve.

Gahnia aspera, Spreng.—Dorrigo and Glenfernie Forest Reserves.

Carex inversa, R. Br.—Dorrigo Forest Reserve.

Carex declinata, Boott.—Dorrigo Mountain.—The locality appears worthy of note for this species.

Carex contracta, F. v. M.—On the banks of Blick's River, near Tyringham.—Previously only recorded from Tenterfield and Timbarra (also in the Tenterfield district).

Carex pseudo-cyperus, Linn.—Banks of Blick's River, near Tyringham.

GRAMINEÆ.

Paspalum scrobiculatum, Linn.—Bellinger River.

Panicum leucophæum, H. B. et K.—Tyringham to Bald Hills.

Panicum gracile, R. Br.—Dorrigo Mountain.

Panicum marginatum, R. Br.—Dorrigo Forest Reserve.

Oplismenus compositus, Beauv.—Bellinger River and Dorrigo Forest Reserve.

Pennisetum compressum, R. Br.—In patches, or large tufts, from Bald Hills, through Guy Fawkes to Wollomombi.—A very tough grass, but always showing signs of having been eaten by stock when young.

Lappago racemosa, Willd. (Syn. *Tragus racemosum*, Desf.)—Bald Hills, but not much of it seen.

Hemarthria compressa, R. Br.—Foot of Dorrigo Mountain.

Andropogon sericeus, R. Br.—Dorrigo Forest Reserve.

Andropogon refractus, R. Br.—Dorrigo Mountains.

Imperata arundinacea, Cyr. "Blady-grass."—Dorrigo Mountain, Forest Reserve and throughout New England.

Chrysopogon paviflorus, Benth.—Dorrigo Forest Reserve.

Sorghum plumosum, Beauv.—In the "plains" of the Dorrigo.—At the time of my visit this and kangaroo grass were flowering in the greatest profusion, and were the two most conspicuous grasses seen. There seem to be differences of opinion in regard to the value of this grass. It is abundant nearly as far as Guy Fawkes, and a squatter told me his stock usually left it to the last.

Anthistiria ciliata, Linn. "Kangaroo Grass."—Very abundant in the plains of the Dorrigo.

Microlæna stipoides, R. Br. (Syn. *Ehrharta stipoides*, Labill.)—Dorrigo Forest Reserve and Bald Hills.

Dichelachne sciurea, Hook. f.—Dorrigo Mountain to Bald Hills.

Agrostis scabra, Willd, var. *elatior*, Benth.—Bald Hills to Guy Fawkes.

Agrostis breviglumis, F. v. M. (Syn. *Deyeuxia* (?) *breviglumis*, Benth.)—On the banks of Beilsdown Creek, Dorrigo Forest Reserve, with *Scirpus*, &c. Previously recorded locality, "New England" (C. Stuart).

Deyeuxia Forsteri, Kunth.—Dorrigo Forest Reserve, right onward to Guy Fawkes and the Round Mountain.—Very abundant.

Deyeuxia Billardieri, Kunth.—Guy Fawkes and the Round Mountain.—Erect and slightly scabrous. The locality given appears to be new.

Deyeuxia quadriseta, Benth.—Bald Hills.

Danthonia pallida, R. Br.—Bald Hills.

Danthonia longifolia, R. Br.—Bald Hills.

Echinopogon ovatus, Beauv.—Dorrigo Forest Reserve to Bald Hills.

Chloris truncata, R. Br.—Dorrigo Forest Reserve to Bald Hills.

Sporobolus indicus, R. Br.—Bald Hills.

Isachne australis, R. Br.—Dorrigo Forest Reserve.

Eragrostis Brownii, Nees,—Tyringham to Bald Hills.

Poa cæspitosa, Forst.—Dorrigo Mountain, right through Dorrigo Forest Reserve, through New England to Guy Fawkes and the Round Mountain (on the very summit).—Two or three forms collected.

Agropyrum scabrum, Beauv.—Tyringham to Bald Hills, by the roadside.

FILICES.

Lygodium scandens, Swartz. "Climbing Maiden-hair."—On trees on the Bellinger towards the Heads.—Hitherto not recorded from further south than the Clarence River.

Gleichenia dicarpa, R. Br.—Tyringham to Bald Hills.

Gleichenia flabellata, R. Br.—Dorrigo Forest Reserve.

Todea barbara, T. Moore.—Dorrigo Mountain and Dorrigo Forest Reserve.

Alsophila australis, R. Br.—Dorrigo and Glenfernie Forest Reserves.

Davallia dubia, R. Br.—Beilsdown Creek, Dorrigo Forest Reserve. Found also on the very summit of the Round Mountain, near Guy Fawkes.

Vittaria elongata, Swartz.—Dorrigo Forest Reserve.

Lindsæa linearis, Sw.; *L. microphylla*, Sw.—Dorrigo Forest Reserve.

Adiantum æthiopicum, Linn.—Dorrigo and Glenfernie Forest Reserves.

Adiantum hispidulum, Swartz.—Dorrigo and Glenfernie Forest Reserves.

Pteris tremula, R. Br.—Dorrigo Forest Reserve.

Pteris aquilina, Linn., var. *esculenta*, Hook.—On the very summit of the Round Mountain.

Lomaria discolor, Willd.—Dorrigo Forest Reserve.—Apparently not hitherto recorded further north than the Hastings River.

Blechnum serrulatum, Rich.—Dorrigo Forest Reserve.

Asplenium nidus, Linn. "Bird's Nest Fern."—Dorrigo and Glenfernie Forest Reserves.

Asplenium flabellifolium, Cav.—On the very summit of the Round Mountain.

Asplenium falcatum, Lam.—Dorrigo Forest Reserve.

Asplenium flaccidum, Forst.—Exceedingly abundant in the Dorrigo and Glenfernie Forest Reserves, and particularly the former. Hangs in tufts from every *Fagus*, and from other trees.

Aspidium ramosum, Beauv.—Dorrigo Forest Reserve.

Aspidium aculeatum, Swartz.—Bald Hills to Guy Fawkes.—The localities appear to be new.

Polypodium tenellum, Forst.—Dorrigo and Glenfernie Forest Reserves.

Polypodium punctatum, Thunb.—Bald Hills Station.

Polypodium serpens, Forst.—Dorrigo Forest Reserve, Bald Hills, and right on to Guy Fawkes and the Round Mountain, on the very summit of which it was found.

Polypodium confluens, R. Br.—Bostobrick and Glenfernie Forest Reserve.—Fronds quite fleshy.

Polypodium attenuatum, R. Br., typical form.—Glenfernie Forest Reserve; also form with very long fronds. A large proportion of the fern-growth in the Dorrigo and Glenfernie Forest Reserves appears to consist of *Polypodiums*.

Polypodium pustulatum, R. Br.—Dorrigo Forest Reserve.

Polypodium scandens, Forst.—Dorrigo Forest Reserve.

Notholæna distans, R. Br.—Glenfernie Forest Reserve.

Platycerium alcicorne, Desv. "Elk-horn Fern."—The report of the occurrence of this fern in quantity appears to be founded on a misapprehension. My tracks through the Don Dorrigo Reserve aggregated perhaps 100 miles, and I never saw one stag-horn. There is one small elk-horn in Glenfernie Forest Reserve, near Kirkwood's pine-mill. In neither reserve did I see a single stag-horn fern. I therefore am prepared to say that neither fern is widely distributed in the reserves referred to.

Acknowledgments.

My best thanks are due to Mr. Walter Mecham, at that time forester of district, who piloted me through, and helped me in a variety of ways; to my kind travelling companions, Mr. J. V. de Coque and Mr. Arthur J. Vogan, who felled trees for me, helped me in various ways to collect and make observations, and also to render more comfortable what was by no means a luxurious undertaking. To Mr. Henry Deane, Engineer-in-Chief for Railways, I am indebted for tracings of the trial surveys of the proposed railway in the Dorrigo country; these enabled me to strike boldly into the forest without fear of getting lost. Lastly, to my friend and cclleague, Mr. R. T. Baker, who has very kindly assisted me, often at great personal inconvenience, in working out my collections.

Three local residents in particular helped me greatly with my work, viz.:—F. T. Matthews, Esq., J.P., of Bellingen; Walter Beauchamp, Esq., of Bald Hills Station; and Mr. H. Purkiss, of Guy Fawkes.

Murrumbidgee Experimental Farm, North Wagga Wagga.

By J. COLEMAN.

It was decided by the Department of Agriculture to establish an experimental farm in the Riverina (which is the largest wheat and grain growing district of the Colony, and is designated by our Government Statistician, Mr. Coghlan, the granary of New South Wales), with the object of growing and practically testing the many different varieties of wheats, and to select some of the most productive, best milling, and rust-resisting sorts, suitable for growing in this large district, as well as other parts of the Colony. Wheat being the only crop grown to any extent about here, it was also thought advisable to try the growth of other grains, such as Chevalier barley, for malting purposes, for which there is, if well grown, a good local demand, as well as for export to England, and thus realizing a higher price than wheat in the home market.

Oats, again, there is a good demand for if well grown, the returns being more per acre than the average crop of wheat grown these last few seasons; peas, for storekeepers' requirements, and various other crops for rotation; also experimental crops, in order to ascertain what this soil and climate will grow to perfection.

It is also proposed in the near future to establish a school of instruction for young men to learn practical agriculture, to enable them to reap the greatest benefit by increasing the crops through proper cultivation of the soil under a system of rotation of crops, application of natural and artificial manures at the right time, and a careful selection of seed grain. With these objects in view, the present site was selected, being centrally situated, and the soil of about equal quality to very many thousands of acres of scrub and forest land in this part of the Colony.

The farm is situated about 5 miles north of the town of Wagga Wagga, and about 4 miles from Bomen Railway Station, on the Great Southern Line, 305 miles distant from Sydney. It forms part of the North Wagga Wagga temporary common, and was selected as being within easy distance of the railway station and the town of Wagga Wagga, and almost adjoining the old Junee Road to Sydney. The farm is about 2,000 acres in extent, and was the ordinary forest land found in this large district, timbered with red gum, white and yellow box, scrub, and a sprinkling of native pine—all green timber. The soil is the ordinary red, loamy soil, very sticky, and heavy to work, and rather under the average quality of the large area of forest land found in the Riverina district. The eastern portion of the farm has a granite range of hills running through the two highest points, called the Sister Hills, and on one is placed Bald Hill Trig. Station, as marked in survey map of the Colony. These hills are a land-mark, and can be seen for many miles around.

The soil about these is decayed granite and some few patches of rather a volcanic nature, more particularly on the eastern side. On this eastern slope it is proposed to plant an orchard and vineyard of about 75 acres, which will be under the charge of an orchardist.

There is no permanent water supply on the farm, therefore provision has to be made by digging tanks and conserving the rain water. The land being hilly and undulating there are several suitable spots having a large catchment area for collecting and conducting the rain water to them when made. There is one nearly finished of 6,000 yards capacity, and the under soil is of a splendid holding quality.

A very large proportion of the land away from the river flats depends entirely on tanks for its supply of water in this district.

The average rainfall for the past five years was about 28 inches per annum.

The first work to do on taking possession was to begin to clear the land; and that portion selected for the orchard and vineyard site was taken in hand first. Green timber of large dimensions, such as red gum, white and yellow box, and the necessity for taking the roots out 2 feet in depth, required somewhat greater labour than the clearing of ordinary land where the timber had been ring-barked for ten or twelve years previously, and the roots taken out only 9 inches in depth. The grubbing was done in the following way:—The soil was taken out half-way around each tree, all roots being cut close to the stem, including, if possible, the tap root, and again about 5 feet from the tree, and the soil taken out as deep as the roots run in that direction. Then, with a good bullock team and a long wire rope hitched to the stem of the tree as high up as possible, the higher the better, and pulling directly over the hole excavated on the one side of tree, it is easily hauled down, and the remaining roots at the back of the tree are drawn out of the soil. This is one of the best methods of clearing green timber where a bullock team is available.

After the trees were down the next operation was to cut up and split posts for fencing, and enclosing the farm and the division of various paddocks as required.

Having no timber fit for splitting rails the following style of fence was adopted:—Posts, 6½ feet long by 6 inches wide and 4 inches thick, were sunk 2 feet in the ground and 4½ feet out, the tops roughly squared up to give it a neat appearance. The posts were placed 7 feet apart, with six plain No. 8 steel wires, and one barbed wire on top, along the centre of posts. This is a very strong, substantial, cattle-proof fence, and the cost of erection is very moderate.

If at any future time rabbit-proof netting is required, the posts having been squared, the netting could be easily put on.

The Season of 1893.

Early in April it was decided to clear a small portion of land chosen for the farm proper, to try sundry crops of grain in a small way, for the purpose of testing the land.

Dr. Cobb, the pathologist of the Department, has made several experiments during the last year or two on many varieties of wheat from various parts of the world for the purpose of testing their rust-resistant qualities, productiveness, &c. About the middle of May he brought up and had planted some 200 or 300 sorts in drills, side by side, to test their qualities and to select the best of them for future sowing.

With good culture and careful selection some magnificent early sorts have been saved for the season of 1894. Many of these are very rust-resistant, with strong, good straw, and grain of good milling quality. Although these wheats were planted in four days at harvest time, there was from three weeks to a month's difference in the time of ripening.

Half a bushel each of two of the best Chevalier barleys were sown, viz., Goldthorp and Carter's Prize Prolific, with fairly good results, considering that imported cereals from England require one year's growth to become acclimatised. Cape barley and Skinless barley both produced good crops.

Oats.—Algerian, Calcutta, and Red Texas produced good crops. One bushel of Carter's Royal Cluster oats, drilled in a foot apart, produced a splendid crop of excellent quality grain, the straw being from 5 to 6 feet high, of a very clear, bright colour, and very strong. This variety is certainly the best I have seen, and is very suitable for this district.

Peas.—The following sorts were tried:—Ordinary Dunn, Maple or Partridge, Black-eyed Susan, Small White, Blue Prussian, Yorkshire Hero, and Large Blue Imperial. They all grew very fair crops. Black-eyed Susan and Large Blue Imperial were by far the most prolific and the best in quality.

Rye.—Common English and Arctic rye were grown. The Arctic variety was very much the stronger grower, and produced nearly a third more grain than the English. The straw was from 12 to 18 inches longer, and of a bright, clear, good quality.

Vetches.—Three sorts were sown—the Golden, Scotch Gores, and the Black English Winter. The latter is much the strongest and most robust in haulm, and would be an excellent crop to sow for the purpose of ploughing in the soil for green manure, where the land has become exhausted by continuous cropping.

Potatoes.—The following sorts were planted in rows 3 feet apart:—Brownell's Beauty, Early Rose, Magnum Bonum, Richter's Imperator, White Elephant, Scotch Grey, Ruby, Flourball, and Myatt's Ashleaf. The sorts that produced the best crops were Richter's Imperator, White Elephant, Brownell's Beauty, and Magnum Bonum. These grew very heavy crops of good quality. To ensure a good crop potatoes must be planted early in this district before the dry weather sets in.

Tobacco.—Sixteen varieties of seed were sown, but owing to the dry spring, and having only raw, new soil available, from which the green timber had been recently removed, the seeds germinated badly. The few plants that did grow made very coarse ones, some of them attaining 6 feet in height.

The Harvest of 1893.

After careful examination of the many varieties of wheats grown here, those considered the best and most suitable, taking into consideration their rust-resistant, milling, and prolific qualities, were selected and saved for seed purposes for next season.

The Chevalier barleys, Goldthorp and Carter's Prize Prolific, were also saved for seed.

Oats.—Only the Carter's Royal Cluster oats were saved for the 1894 crop. This is a splendid variety, and will be one of the best for the district.

From April to December, as time and hands employed would permit, extra land was cleared, ploughed, and cultivated for next season's crops. Boundary fences were erected, paddocks divided, and other necessary work done to convert ordinary forest land into a cultivated experimental farm.

Season of 1894.

As a farm crop about Wagga Wagga turnips are not grown to any extent, the climate being considered too hot and dry, farmers, as a rule, allowing the natural grasses to be the only food for the sheep and cattle to eat. As a test crop, on the 16th of January, the land having been ploughed and harrowed in readiness, I drilled rows 3 feet apart, on the surface of the soil, afterwards horse-harrowing in, seed of the following varieties:—New hardy Green-top Swede, Carter's Elephant Swede, Crimson King Swede, Purple-top Mammoth, Green Globe, Devonshire Stone, Green-top Hybrid, and Purple-top Hybrid.

After they were well up in leaf, about 2 cwt. per acre of bone-dust from Messrs. Halloran & Co.'s boiling-down works, Lake Albert, at 65s. per ton, was sown broadcast over them, and the horse harrows drawn over across the rows. After a few days they were set out by hand hoe, about 15 inches apart from plant to plant in the rows. The result was a magnificent crop of turnips, exceeding all expectations. The heaviest crop of the Swedes was Carter's Elephant, producing over 25 tons per acre. The other varieties of Swedes were also heavy crops.

The heaviest of the white-fleshed turnips were the Purple-top Mammoth and Purple-top Hybrids, and these grew more per acre than the Swedes, very many of them being over a yard in circumference.

From these results, and this being a thorough sheep district, a few acres of well grown Swedes would be splendid food for stud sheep in their preparation for exhibition at the several agricultural shows. The attention of squatters and exhibitors of sheep and cattle may well be called to the growth of this valuable crop.

Potatoes.—A few were planted on the 22nd and 23rd of January as a test autumn crop, and the following were the only sorts out of over sixty varieties that produced anything like a crop:—Brownell's Beauty, Snowflake, Magnum Bonum, Richter's Imperators, White Elephant, and Early Rose. The uncertainty of rain during January and February is a great drawback to the successful growth of an autumn crop of potatoes in this district.

Wheat-sowing Season of 1894.

At last harvest the best and most suitable varieties were saved to sow on as large a scale as seed would permit. There are also some twenty or more of the best American and Californian sorts, especially imported by the Department of Agriculture for the purpose of testing their rust-resistant, prolific, and milling qualities, and their suitability for growth in this Colony.

The following American varieties are sown in plots from half to 1 acre of land each:—New Red Wonder, Jones' Winter Fife, Winter Nigger, Mediterranean Hybrid, Canadian Velvet Chaff, Reliable, Red Russian, Fultz, Golden Cross, Early Red Clauson, Hindoostan, Early Genesee.

Californian varieties.—Sonora, Pride of Butte, Chili, Chico Club, Prapo, Virgin, Defiance, Blue Stem, Fife, Oregon Valley, Walla Walla, Genesee, Tuscany, Improved Clauson, Fultz, and Lancaster.

Home-grown varieties.—The following are those sown this year, being selected varieties of those grown on the farm last season, and are sown on areas ranging from ¼-acre plots to 17 acres in extent:—Canning Downs, Clawson, Algerian, Bega, White Hogan, Farmer's Friend, Leak's, Velvet chaff, Berthoud, Belatourka, Early Para, Australian Talavera, Gross's Prolific, Steer's Early Purple Straw, Hudson's Early Purple Straw, Allora Spring, Blount's Lambrig, Square Head Sicilian, Improved Fife, and Marshall's White.

Malting Barley.—Only two varieties were sown, viz., Goldthorp and Carter's Prize Prolific, both of which are first-class Chevalier barleys. A plot of Skinless barley is also sown.

Oats.—Only the one variety, Carter's Royal Cluster, was sown on about 12 acres of land. All these cereal crops are sown on the ordinary system of agriculture, and the greatest possible care will be taken to keep every variety true and distinct, each sort being sown having a 3-foot pathway between every lot, to ensure their not being mixed, at harvest-time, also to allow facilities for pulling up and carrying away all impure and bastard varieties found growing among them. All are carefully gone through several times before harvest, and every plant not true is pulled up and carried away. The object is to have every variety pure and true to name. Many of these wheats, barleys, and oats will be grown in sufficient quantities for distribution amongst farmers, for next year's sowings, but in what manner will be decided by the Department of Agriculture.

Experimental Wheats of 1894.

About 10 acres is set apart for trial wheats under the direction of Dr. Cobb, for the purpose of testing their rust-resisting and various other qualities. Wheats will be found growing here side by side of several hundred varieties obtained from all the wheat-growing countries of the world.

There is also a large number of new crossbred wheats, for testing and selection of new varieties, with the hope of obtaining some really good new sorts worthy of cultivation.

It is the wish of the Department of Agriculture that all farmers and others interested in the growth of wheats and various other cereals will visit this farm and inspect the various crops growing there a short time before harvest is commenced, as this is the only place where such a large number of varieties can be seen growing on the one farm.

All information as to the cultivation, selection, and the various other items will be given on a visit of inspection to the farm.

The Cultivation of Sugar Beet.

(*Being a Lecture delivered at Tenterfield, August* 3; *Guyra and Armidale, August* 24, 1894.)

BY J. L. THOMPSON,
Principal, Hawkesbury Agricultural College.

ALTHOUGH a considerable amount of space has already been devoted to the subject of sugar beet cultivation in the columns of the *Gazette*—for instance, the valuable articles of Mr. F. B. Kyngdon, M.R.A.C., Vol. I., Part 1, July, 1890, and Mr. J. A. Despeissis, M.R.A.C., Vol. II, Part 4—the desire for detailed information from many parts of the Colony, more particularly the New England district, at the present time is so great that I venture to contribute the following notes, which I trust will prove of some use to those desirous of embarking in this industry:—

History.

The beet belongs to the "Chenopodiaceæ" or "Salsolaceæ," an order of plants giving us many useful forms, amongst them the native saltbushes. The sugar beet, *Beta vulgaris crassa*, is supposed to have been developed from the wild beet, *Beta vulgaris maritima*, which is indigenous to the countries along the coast of Southern Europe. The beet was known as an esculent root in the time of Pliny, who has given an accurate description of it in his work. It is a biennial plant, *i.e.*, of two years' duration. The first year it produces a full-sized root; the second year it produces its seeds, and then dies off. Sometimes a few plants produce seed the first year; this is the result of using inferior seed, of which more anon.

Discovery of Sugar in the Beet.

It was in the year 1747 that the great German chemist "Margraff" discovered the existence of sugar in the beet. He communicated the facts of his discovery to a scientific society in Berlin, but no practical use was at the time made of it.

Forty years after this, "Achard," another Prussian, resumed the experiments commenced by "Margraff," and the first beet-sugar factory was established by him at Karlsdorf, near Berlin, in the year 1776. Three years later another factory was established in the Prussian province of Silesia. The yield of sugar was, however, very small, not exceeding 3 per cent., and the sugar made was of a very inferior quality.

The Institute of Paris did not sympathise with the enthusiasm of Achard, for in 1800 a committee of that body, having carried out a series of experiments with the beet, reported that, as the results were so unsatisfactory, it

would be unwise to establish factories in France. The matter would probably have rested here, and Europe would have continued to receive its supplies of sugar from countries adapted to the growth of the sugar-cane had not the decrees of Bonaparte, in 1809, excluded France from purchasing the produce of the West Indies. Sugar had, however, become an article of the first necessity to a large number of the French people. The public dissatisfaction at the Milan decrees was, therefore, excessive, and there arose a cry for sugar. Napoleon did his utmost to lessen the inconveniences that his political schemes had imposed upon his people. Manufactories for the production of syrups from grapes and honey were established, but sugar or a crystallised saccharine substance could not be procured.

M. Deyeux, a member of the committee appointed by the Emperor to take steps to supply the wants of the people in the matter of sugar, turned his attention to the beet-root. His experiments were most successful, much more so than those of the committee of 1800, probably because the necessity for producing sugar at home was now more pressing. An Imperial manufactory was forthwith established at Rambouillett. Schools were instituted for instructing pupils in the process of its manufacture. Premiums were given for the best crops of beet and the best samples of sugar, and by 1812 the manufacture of beet-root sugar was settled on a firm basis.

The profits of the producers were so large that in one or two years they were reckoned sufficient to cover all the expenses of the establishment.

There was no competition to speak of, and of course the enormous profits made were paid by the consumer. The French people obtained sugar, but they had to pay an extravagant price for the luxury. In 1814 Europe was at peace, the ports of France were again open to the produce of the West Indies, and cane sugar once more flooded the markets, but France had learnt how to produce sugar within her own borders. The various European governments now began to note the importance of the industry, and gave it every encouragement. It has now developed into one of great magnitude, and may be said to be of such importance that to it many countries owe their prosperity.

Consumption of Sugar.

It appears that the world consumes now twice as much sugar as it did in 1870, and four times as much as in 1850. The fall in price no doubt partly explains this prodigious increase.

Sugar, either cane or beet, was almost an unknown product previous to 1700, and as a rule was only kept by chemists. The following figures, taken from Mulhall's Dictionary of Statistics, show the increase in the use of sugar in the United Kingdom over a period of 180 years:—

Year.	Tons.	lb. per inhabitant.	Duty per ton.	Price per ton.
			£	£
1705	12,000	3	3	70
1730	41,000	9	4	70
1750	53,000	11	5	70
1780	77,000	14	7	70
1801	165,000	22	20	85
1820	143,000	15	27	63
1840	188,000	15	24	48
1860	690,000	49	5	32
1888	1,170,000	70	.. ...	14

The use of sugar in France has increased per inhabitant from 2 lb. in 1817, to 23 lb. in 1887. The following table gives the world's production of cane and beet sugar during seven years ending 1890:—

Year.	Beet Sugar.	Cane Sugar.	Total Production.
1884	2,361,000	2,323,000	4,684,000
1885	2,546,000	2,351,000	4,897,000
1886	2,220,000	2,340,000	4,560,000
1887	2,730,000	2,345,000	5,075,000
1888	2,452,000	2,470,000	4,922,000
1889	2,765,000	2,280,000	5,045,000
1890	3,500,000	2,278,000	5,778,000

It will be seen from the above table that the production of cane sugar has diminished, while the production of beet sugar has greatly increased.

The chief beet sugar producing countries, in order of importance, are Germany, Austria, France, Russia, Belgium, Holland. Of cane sugar—Cuba, Java, Brazil, India, Jamaica, Manilla, Mauritius, Guiana, China, Guadaloupe, United States, Porto Rico, Honolulu, Argentine, Egypt, Peru, Mexico, and Australia.

The extent of country in Australia suitable for sugar-cane is, so far as climate is concerned, enormous. It may be noticed that no other country, with the exception of the United States, produces both beet and cane sugar, whilst the variety of soil and climate with us is so marked that both kinds can be produced here with success.

Quoting from Mr. Coghlan's "Statistical Account of the Seven Colonies of Australasia, 1893," p. 210. We find the production of sugar from cane crushed during the six years ending 1891, as follows:—

	1886.	1887.	1888.	1889.	1890.	1891.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
New South Wales	13,750	22,500	11,279	19,016	26,533	25,245
Queensland	56,859	57,960	34,022	44,411	68,924	51,219
Totals	70,609	80,460	45,301	63,427	95,457	76,464

Queensland produces more than sufficient for its own requirements. The other colonies imported sugar during 1891 as follows:—

	Quantity.	Value.
New South Wales	31,245 tons.	£563,927
Victoria	54,043 „	875,450
South Australia	17,998 „	293,586
Western Australia	2,416 „	60,410
Tasmania	5,123 „	97,230
New Zealand	27,531 „	371,523
Australasia	138,356 „	£2,262,126

It will be seen that there is ample scope for the further development of this industry both from cane and beet before sufficient sugar is produced to supply the wants of Australasia.

The Best District for Sugar-Beet Cultivation in New South Wales.

Mr. Despeissis describes the New England district, comprising all that part of New South Wales extending northwards along the Dividing Range from Armidale to Tenterfield, as being especially suited to the cultivation of sugar-beet; and there is no reason why the two industries "cane" and "sugar beet" production should not flourish within a few miles of each other; and from a personal inspection, during the past three weeks, I am satisfied that both soil and climate are admirably suited to the growth of this important crop.

Soil Suited for Sugar-Beet.

The soils most suitable for sugar-beet are well-drained, deep, friable loams. Porosity of surface and subsoil is desirable, to admit of superfluous water being drained away, and of free circulation of the air, and to encourage its power of absorbing and holding in a condition convenient for ready assimilation the elements of plant food existing therein or applied in the form of manure. On calcareous soils the roots are generally small, yielding a juice of great purity, and rich in sugar. The subsoil has also an important influence on the quality of the root. Indeed, the physical properties of a soil are of more importance than the chemical, as the necessary food constituents can be supplied in the form of fertilizers. The Australian chocolate soils, derived from the disintegration of basalt, may be regarded as suitable for sugar-beet production.

Climatic Conditions.

M. de Vilmorin, who has done so much towards improving the sugar-yielding capabilities of the beet root, says that climatic conditions have a very important influence upon its value for sugar production. A medium temperature, averaging from 65° to 70° F. during the growing months, a somewhat rainy summer, and a clear, cool autumn, being most favourable to the development of the crop. The New England district possesses all these essential qualifications.*

Preparation of the Soil.

Land intended for sugar-beet should be taken in hand early in the autumn. Too much stress cannot be laid upon the necessity for careful preparation of the land. To obtain long, clean, properly-shaped roots the plants must have a sufficient depth of soil to grow in, as nothing fosters the development of side roots more than tho stoppage of direct growth in the tap root by the hardness of the subsoil. Subsoil ploughing must, therefore, be resorted to. This can best be accomplished with two teams, the first an ordinary plough, turning a furrow (say) 6 or 8 inches deep. An ordinary plough with the mould board taken off makes an excellent subsoiler, and this should follow the first plough, being regulated to stir the subsoil another 6 or 7 inches, a good 14 or 15 inches in all. This will be plenty deep enough for average sugar-beet. The root should be almost entirely buried in the soil. The land should remain in this rough condition throughout the winter, when it should be again ploughed if necessary, and thoroughly worked and pulverized by means of disc-harrows, rollers, or other implements, to ensure a perfect tilth, not only on the surface, but to a good depth.

* *See* Mr. Despeissis' article, *Gazette*, vol. 2, page 130.

Selection of Seed.

Seeds of those varieties giving the highest percentage of sugar should be chosen. The Department of Agriculture, at the request of Mr. C. A. Lee, M.P., of Tenterfield, is importing, through the Agent-General, from Vilmorin's, Paris—

50 lb. Heina's Vilmorin.
50 „ Vilmorin's Improved.
25 „ Paris Yellow.
25 „ Imperial Red.
25 „ White Silesian.

Also an assortment from two other French seedsmen, who make the raising of sugar-beet seed a speciality. It is expected that these seeds will arrive in ample time for distribution and sowing this season; the proper time for sowing in the New England District being during the month of September.

The composition of the seeds varies greatly not only with the variety of the roots to which they belong, but with each other. This, with the size of the seeds, seems to have an actual influence on the resulting root. It has been proved by experiment in France that the larger the seed the larger the root, and the less percentage of sugar; the smaller the seed the greater the amount of sugar found in the beet.

The density of the seeds is a good test, those sinking to the bottom in a vessel of water yield roots richest in sugar; again, if the water has greatly changed its colour we may safely conclude that the seeds are old. It is difficult to make a distinction between the seeds* of the sugar-beet and those of the mangel wurzel, as in external appearance they are very similar, both having rough capsules, each containing two and sometimes as many as four seeds.

Treatment of the Seed before Sowing.

In order to hasten germination the seed should be soaked for twenty-four or even thirty-six hours in a solution of one part rain-water and one part urine, human or bovine, at a temperature of 100 degrees to 120 degrees Fahr.; prolonged immersion in pure water removes from the seeds some of their soluble constituents; the seeds will absorb about their own weight of the mixture, and on being taken out should be mixed with some finely pulverized wood ashes, dried on the surface, and are then ready for sowing. If the after conditions as to heat, light, and air are satisfactory, the young plant should make its appearance in from eight to ten days. From experiments conducted in France the seeds require for germination a total degree of average temperature equal to 650 degrees Fahr.; thus, if the average daily temperature is sixty-five, ten days will be required for germination. A temperature of over 122 degrees F. is fatal to germination.

Depth to Sow the Seed.

Groven, a celebrated experimentalist, from numerous tests, concludes that the most suitable depth is 1 inch if the ground is moist, and slightly deeper if the land is somewhat dry. Many farm and garden seeds do not

* The so-called seeds are really fruits.

germinate because they are buried too deep, and consequently out of reach of the necessary conditions. "Nature sows her seeds very shallow," and weeds generally grow well, especially where they are not wanted.

Distance Apart to Sow.

It is important to know the most favourable distance at which to place the roots most advantageously to the farmer and the sugar manufacturer. This varies with the soil, as the richer and deeper it is the closer the roots can be grown; a poor soil would require a greater number of square inches in surface to furnish the necessary nourishment than a rich one. Experiment and experience prove that roots of moderate size yield a juice which contains a smaller percentage of mineral and organic impurities, and afford a greater yield of sugar than large ones, and up to a certain point it must therefore be regarded as an axiom that the smaller the root the richer the sugar and *vice versa*. The "ideal beet" should not be less than 1½ lb. or more than 2½ lb. in weight. As a general rule the distance in Europe is never more than 16 inches between the rows and 8 inches apart in the rows; this will give above 48,000 plants to the acre. A heavy seeding, sometimes in Europe as much as 30 lb. per acre, is given, as it is only by the liberal use of seed that a sufficiently-close crop can be assured, especially under unfavourable conditions as to weather, &c. Considering our genial climate I agree with Mr. Despeissis that from 16 to 20 lb. of seed would be sufficient.

Method of Sowing.

Small plots of ¼ or ½ an acre for experimental purposes can of course easily be sown by hand; but when beet cultivation is carried out on an extensive scale a seed drill should be used. This machine delivers the seed regularly, covers it evenly, and sows fertilizers at the same time, if required; it combines in itself the functions of drill, hoe, moulder or ridger, shown in figures 1 and 2. The different appliances are fitted to the frame of the machine, according to the use to which it is to be put. The drill, complete, would cost about £40, and sows six rows at a time. The ordinary one row horse-hoe is not suitable for beet cultivation; the rows, being only 16 inches apart, would not give sufficient room for working; it may be used, however, but is very slow, and great care is necessary in order that the young plants shall not be cut or destroyed. The Planet Junior Horse Hoe can be safely recommended for this work.

Thinning and After-Cultivation.

When the plants show four leaves the process of thinning should commence; if the rows be 16 inches apart a vigorous plant should be left every 8 inches. Careful selection should be made, and all puny plants destroyed; it is better to save the vigorous plants, even if regular intervals are not exactly preserved; but no space should be left in the rows greater than 12 inches, otherwise the roots will grow too large. Much of the thinning can be done by means of a narrow hoe, but to preserve the plants from injury hand thinning must also be resorted to, to a great extent. The plants having been carefully thinned, subsequent cultivation may be carried on by means of horse-power. Cultivation should be carried out at least

once a fortnight during the period of growth; this is necessary for the two-fold purpose of keeping the crop entirely free from weeds, and preserving a proper tilth in the surface soil.

I cannot too strongly urge the necessity of thorough pulverization of the soil during the period of growth of the beet. No crop derives more benefit from frequent hoeing than this; by stirring the surface soil air enters, dew is absorbed, and nitrification is encouraged.

(To illustrate this point, I may say that careful experiments have been conducted at the Agricultural College Farm with the view to show in what way cultivation affected maize, the result was, briefly, as follows :—

Maize,	not cultivated	yielded	35·22	bushels	per acre
„	once cultivated ...	„	38·50	„	„
„	twice cultivated ...	„	41·37	„	„
„	three times cultivated ...	„	60·41	„	„
„	four times cultivated ...	„	61·42	„	„

thus conclusively proving the extreme value of careful, thorough, and constant cultivation.)

I should here mention that in some of the European beet-producing countries, when the crop is grown on a small scale, plants are raised in a bed in the same way as cabbages, and transplanted to their permanent positions. The principal objection to transplanting is that it is impossible to extract the young root without breaking it; the resulting beet would, in all probability, be forked; blanks in the field should, however, be filled up by transplanting.

Manures and Manuring.

The farmers in the New England district will not require to give this subject immediate attention; for the rich volcanic or alluvial soils no manuring will be required, unless on land which has been under crop for a number of years. Next to the soil, manure has a powerful influence on the quality of the sugar-beet. Beet should not be grown in freshly-dunged soils, as the roots will be poor in sugar and overcharged with saline matter, which is dreaded by the manufacturer of sugar, as it largely prevents the successful extraction of the crystallizable sugar. Farm-yard manure should be applied to the previous crop, or at least some months before the beet seeds are sown. If the land is very poor it will be impossible to grow anything like a crop without manure; in that case manure must be applied. A mixture of guano, bonedust, superphosphate, and sulphate of potash, at the rate of 3 cwt. per acre, will give good results. Ammoniacal salts, guano, rich dung, and, in general, all nitrogenous manures require to be used with caution, as they tend to encourage luxuriant growth of "tops," and to diminish the percentage of sugar in the roots. A certain amount of available nitrogen in the soil appears to be necessary for the healthy development of the plant. Superphosphate of lime may be applied to the land with excellent effect at the time when the seed is drilled in. For soils in good agricultural condition an extra supply of nitrogenous organic matter or ready-formed ammonia does harm, inasmuch as, though it produces a heavy crop, it both diminishes the percentage of sugar in the roots and prevents the manufacturer obtaining in a crystallised form as large an amount of sugar as he can obtain from beet containing the same percentage of sugar but grown without the use of nitrogenous manure. The chief constituents taken from the soil and found in the root and leaves of the beet are potash, phosphoric acid, magnesia, nitrogen. It has been found that a sugar-beet

crop yielding the moderate result of 15 tons of roots and 3·6 tons of leaves abstracts the following quantities of solid matter from the soil:—

	Roots. lb.	Leaves. lb.	Total. lb
Nitrogen	59·4	26·4	85·8
Potash	132	52·8	184·8
Phosphoric acid	26·4	11	37·4
Other substances	85·8	79·2	165
Totals	303·6	179·4	473

Ripening and Harvesting.

The roots should not be harvested until quite ripe. This stage is recognised by the leaves turning yellow and becoming flabby. A good indication of maturity is afforded when a root is cut in two with a knife; if the newly-cut surfaces of the beet rapidly change colour on exposure to the air the ripening process is not completed; if, however, they remain unchanged or turn only slightly reddish it may be taken for granted that they are sufficiently ripe to be harvested. On no consideration must the roots be exposed to heavy frosts. In the sugar-beet growing countries on the continent of Europe the growers have machines for raising the roots. When grown on a small scale the roots may be raised with a pick or the plough, but great care should be taken that none of the roots are pricked or bruised, otherwise they will be liable to decay. When the roots are taken from the ground they should be shaken in order to get rid of any earth adhering to them. The leaves should be separated from the roots either by means of a knife or a sharp spade, care being taken not to cut any part of the root except the neck. The object of removing this portion of the beet is to prevent the mineral salts which have accumulated therein in large quantities from entering the factory. If the roots cannot be carried at once to the factory or silo they should be covered up with their leaves in the field or else with 3 or 4 inches of earth.

Storage of Roots.

A factory having made arrangements for a full supply of roots would not be able to take all at once, a large proportion of the crop must therefore be stored until required for use.

In storing special care should be taken to prevent the roots from throwing out fresh tops, as this is attended by loss of sugar. They may be stored in heaps covered with dry earth in the same way as potatoes are kept in New England, or put in a silo at a low temperature, not to exceed, say, 50 degrees F.

Saving Seed of Sugar-beet.

In selecting plants for the purpose of procuring seed, only uniform well-shaped roots should be used. The tops should be carefully rubbed off, not cut; they should be stored in heaps or silos until the following spring, when they should be planted out in squares, about 3 feet apart. The root will soon show signs of life, flowers will appear, and abundance of seed will be produced, not less than 15 cwt. to the acre.

Harvesting is accomplished by cutting off the tops whole and tying them together in bundles; they are kept until quite dry, and then the seed is is threshed out by means of a flail, or, if on a large scale, by means of an ordinary threshing machine. In sowing the seed the roots of different varieties should be planted a considerable distance apart to prevent cross-

fertilization. In many parts of the continent of Europe the raising of sugar-beet seed is made a speciality and is carried on under the most scientific principles.

Those hereditary principles known to exist in the lower animals and mankind, as is so fully and clearly explained by Darwin and others, are also found in plants. "Like begets like"—hence the selection of the parents in order to obtain satisfactory results; in other words, beets rich in sugar, if planted, will produce seeds from which plants are raised also rich in sugar. Careful selection in the matter of seed also is the means not only of producing good plants but also preventing degeneration of the beet. Growers should look to it, therefore—firstly, that they procure good seed to commence with; and secondly, that in selecting plants for seed production, those only are chosen that are likely to give the best results. The Germans were the first to call attention to this, whilst the French, more particularly the house of Vilmorin, have done immense service; indeed, it has been by a system of careful selection that the percentage of sugar in the beet root has been raised from less than 5 in its original condition to 18 and even 22½ has been recorded in Victoria. All our productions, whether of field, garden, or orchard, as well as live stock, have been improved by judicious selection of parents. I fear the farmers of New South Wales are not careful enough, as a rule, in the selection of their seeds. It is just as important to select good pedigree seed as it is to select a good stallion, bull, or ram when a sire is wanted.

A good illustration of the value of first-class seed was proved by me at the Dookie Agricultural College farm in Victoria. In the year 1879 I saw that the Hon. J. H. Angas of South Australia had obtained a fifty guinea cup at the autumn exhibition of the Royal Agricultural Society held in Adelaide in that year, for 100 bushels of wheat, weighing 69¼ lb. per bushel. I made up my mind to obtain some of this seed, and ultimately purchased 8 bushels at a high figure. This I sowed on 10 acres of clean fallowed land, and the resulting crop yielded 30 bushels per acre of magnificent wheat, with which I gained the Messrs. Goldsbrough & Co.'s forty guinea gold cup in February, 1881, which was offered by that firm for the best 20 bags of wheat grown in the north-eastern division of Victoria, there being 34 competitors. This wheat weighed 69½ lb. to the bushel, and was pronounced by experts to be the best natural sample ever seen in Australia. This wheat subsequently obtained numerous highest awards at Adelaide, Melbourne, New Zealand, and South Seas exhibitions, and to crown all, the Grand Prix at the Paris Exhibition for the best wheat exhibited.

I maintain, that without the selection of first-class seed in the first instance, these successes would have simply been impossible.

To return, however, to the selection of roots desirable for seed production, only such as are rich in sugar should be selected. A test as to their specific gravity can be easily taken in this way. Take a large tub or barrel and fill it with water, dissolve in this a quantity of salt or sugar until a required density is reached, in the same way as is done in preparing a pickle for curing meat, generally strong enough to float an egg or a potato; wash the roots perfectly clean and put them into the liquid; select for seed those that sink and reject those that float. Another method, is to ascertain the specific gravity of the juice in the root; this may be done by boring out of the roots small pieces, the juice must be pressed out and tested with a saccharometer. The hole is filled up with sand, and the root is not damaged in any way, so far as its seed-producing power is concerned. M. Vilmorin brought this method under notice in 1851.

Approximate cost of producing an acre of Sugar-Beet in New South Wales.

	£	s.	d.
Ploughing and subsoiling, 14 inches deep	2	5	0
Second ploughing in spring	0	7	6
Preparing seed-bed	0	10	0
Seed and sowing	0	12	0
Hand-hoeing and singling	0	15	0
Horse-hoeing three times and hilling	0	15	0
Harvesting...	1	5	0
Carting to factory...	1	2	6
Take cost for 1 acre	£7	12	0
Return on same—			
Sixteen tons roots at per ton 16s.	12	16	0
Profit per acre (for the use of land and interest on outlay)	5	4	0

Beet, its place in the rotation.

Beet should follow a white straw crop; it should, if possible, be made to be preceded by and succeeded by a grain crop. Clover or leguminose crops of any kind being nitrogen gatherers should not precede beet; for, under such circumstances, although the roots grow to a large size they remain poor in sugar and take up too much saline matter. All experience points to the fact that repeated sowing of beet on the same land is ruinous to the cultivator, even when immense quantities of farm-yard manure are applied, and where a return is made to the land of all the constituents taken from it by the beet.

A favourite rotation on some of the Austrian beet farms is as follows:— 1. Cereal crop; 2. Sugar-beet; 3. Cereal crop; 4. Lucerne, clover or grasses; Cereal crop, and then Beet again.

Mr. Salatnay, in his articles in the *Melbourne Age* estimates the probable yield at 19 tons per acre, this at 16s. per ton gives a gross return of £15 4s. per acre, and he gives the cost of production at £7 10s. I prefer, myself, rather to under than over estimate the return.

Feeding of Stock with the refuse.

The waste products from sugar factories consist of molasses and refuse pulp. This pulp makes a most excellent cattle food, its value being fully 20 per cent. that of the beet; it possesses important fattening qualities, and it is regarded by some as equal, if not superior in nutritive properties, to the roots from which it is obtained. The pulp may be fed in a fresh state, or preserved in silos; it can also be evaporated and kept in a dry state for any length of time. It is given to fattening beasts mixed with chaff, meal, or other food material. Mr. E. Clarke in his article on "Sugar-Beet cultivation in Austria" in the Journal of Royal Agricultural Society of England, describes a place at Lundenburg where 2,000 cattle are fattened every year; some of them consist of beasts that have done their share of work in the fields, but the majority are bought expressly for fattening purposes. The fattening process only takes 150 days.

Enemies of the Sugar-Beet.

Like all other plants the sugar-beet has its enemies, some insect, others fungoid. In Europe numerous insects damage this crop. The larvæ of cockchafers feed on the roots; weevil larvæ bore into the root and leaf; grubs of many other insects feed on the leaves. A singular disease called "Brown penetration" exhibits in the roots a brown diseased centre which eventually kills the plant. In some cases the plant develops hollow centres. The leaves are attacked by a red-rust fungus, which may do much damage; several other fungous pests are known causing either white spots on the leaf-stalks or the leaves to dry up and become black. Some of these troubles are caused by the plants having been grown too long as successive crops on the same ground, thus showing the value of a proper rotation.

So far as we in New South Wales are concerned, a sharp look out should be kept, and immediate measures taken to prevent serious damage, should occasion require. Any attack to be warded off, should be nipped in the bud by the application of such remedies as would be likely to bring about the desired result.

If grubs are feeding on the leaves, apply Paris green as a liquid spray, 1 lb. to 200 gallons of water, adding 2 quarts of flour—the ingredients to be each well mixed up with a little water before adding the bulk.

In case of travelling caterpillars, for instance the Army worm, which if in great numbers will do much damage, they must be kept out of the crop by ploughing a furrow round it, the land side (towards crop) to be undercut by means of a spade so as to present an overhanging wall of earth, up this the grubs cannot crawl; boiling-water should be freely used to kill them as they accumulate in the furrow.

Burrowing insects are difficult to get at; they can be prevented from laying their eggs, however, by sprinkling over the plants lime and soot.

To guard against fungous pests it would be well to soak all seeds in water having bluestone in it in the same way as we steep grain to keep down smut. In the case of any fungus appearing in the crop, samples should be immediately despatched to the Department of Agriculture for identification and advice.

Utilizing the Leaves during the growth of the Beet.

After my lecture at Tenterfield on 3rd August, a German farmer present asked if it was generally recommended to strip some of the leaves during the period of growth of the sugar-beet and feed them to cattle, as it was the prevailing custom in Germany when he was there many years ago. Now, all experience and experiments in Europe prove unmistakably that although the temptation to the farmer to strip the leaves for cattle food is very great, the harm to the plant, and consequent loss of sugar, is very considerable. At one time it was argued that this stripping of the leaves was of great advantage as it permitted the root to develop better; in reality it has an opposite effect, as nature makes an effort to make up the deficiency by sending out fresh shoots, and it must not be forgotten that the leaves are the lungs and life of the plant. It is now recognized by advanced cultivators that defoliation of vines and other plants has been much abused. Stripping off the leaves has a tendency to cause the neck to become much longer, and the loss of sugar seems to be proportional to the length of the same. The neck contains a greater amount of foreign substance, and less sugar than any other part of the root—the consequence is that there is not only a loss of

sugar resulting from the stripping, but the difficulty of working the beets for the extraction of the sugar is greatly increased. The Germans were the first to call attention to the loss of saccharine elements caused by stripping off the leaves. The results obtained in Germany by analysis from beets stripped and unstripped are as follows:—

	Beets stripped.	Beets unstripped.
Water	88·250	85·600
Sugar	6·210	9·320
Nitric elements	4·559	4·360
Mineral salts	0·981	0·720
	100·000	100·000

Schwartz, a Belgian agriculturist considers, that if 100 represents roots unstripped, 98 would be the yield if stripped once, and 58 if stripped twice.

Beet cultivation in Austria.

At Wischaw is a farm, also described by Mr. Clarke, who says of it "I had the curiosity to inquire somewhat closely into the farm staff, and found it numbered 371, divided as follows:—30 salaried officers; 8 shepherds; 24 foremen; 29 stablemen; 163 herdsmen; 22 dairymaids; 125 labourers; the number of extra hands employed during the season of cultivating and harvesting of the roots is from 2,000 to 3,000. The work of cultivation is paid for by the day, as it is considered that it is done better under this system than by piece-work."

Labour, I am sorry to say, is very low in the beet-growing countries; during harvest the men get 9d. to 1s. per day, and the women 8d. to 10d. a day; in winter the rates paid are even lower.

Oxen are largely used for draught purposes, as they are neater-footed than the horse and when properly trained are more tractable.

An immense quantity of manure is also made, stored, and thoroughly prepared for application to the land; this is an important point in connection with beet-growing in New South Wales which should not be lost sight of.

From the best authorities on the continent of Europe we gather that the immediate result of opening a Beet-root Sugar Factory in convenient proximity to the growers is to increase the value of land one-third and, in some cases, one-half.

Sugar-Beet culture in the United States.

In the United States sundry good attempts have been made to produce sugar from beet root; without, however, going into figures it may at once be said that the quantity of sugar so produced is comparatively small. Experiments have been made by the United States Department of Agriculture with sugar-beets giving satisfactory results in the following States—California, Colorado, Michigan, Minnesota, Nebraska, Nevada, South Dakota, Utah, Wisconsin, Wyoming, as will be seen by the July *Gazette*, which gives a good account of beet cultivation in the United States. It remains to be determined whether economic conditions will warrant the establishment of other factories. The total imports of sugar have reached 81,187,504 dollars in one year, and it should be noted that a considerable quantity is made from the sugar maple tree, sorghum, and corn-stalks, whilst a small quantity is also made from sugar-cane.

Sugar-Beet in the United Kingdom.

I have myself grown as good sugar-beet in Great Britain as could be produced in any part of the world. The question might reasonably be asked how it is that the cultivation of this important plant has not been more successful in that country; the answer is, because the industry had always the opposition of the Government; and this, together with the fact that bounties are paid to growers by most, if not all, the continental Governments, has operated in preventing its profitable cultivation in the United Kingdom. The question of bounties is one of great complication, and beyond the scope of this article. A recent attempt by the British Government to deal with the matter at an International Convention met with disastrous failure. Mr. Salatnay points out in connection with the subject that in 1850 a revenue of £4,130,000 was obtained from sugar, and that in order not to endanger this a duty of 24s. per cwt. was imposed on all sugar made from beet root in the United Kingdom. A restriction of this sort still exists, and in the face of it growers cannot successfully compete with continental production.

Sugar-Beet in Victoria.

Attempts are being made to establish the industry in Victoria. The colony offers a bonus of £2 per ton on the first 5,000 tons of sugar produced and £1 per ton on the second 5,000 tons,—a total of £15,000, which will no doubt be secured by some enterprising company. The New Zealand Government is also encouraging the production of sugar-beet by offering bonuses.

Numerous experiments have been carried out at the instance of the Department of Agriculture in Victoria with most satisfactory results. Six hundred

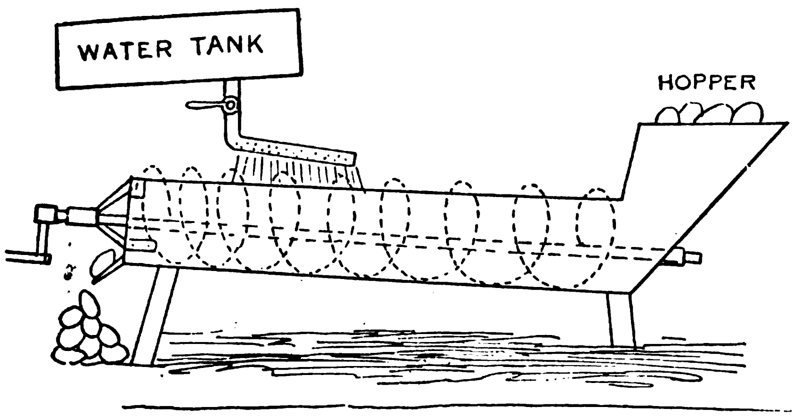


Fig. 1.—Washer, consisting of a spiral carrier in a wooden trough, and a spray of water playing over the roots.

packets of seed were distributed; the results showed a yield of from 15 to 25 tons per acre, the juice containing from 12 to 17 per cent. of sugar. It may be mentioned that 100 lb. of beet roots of average richness contains 7 lb. of refined sugar, in every way as good as that obtained from the sugar-cane. It has been pointed out elsewhere that there should be no difficulty

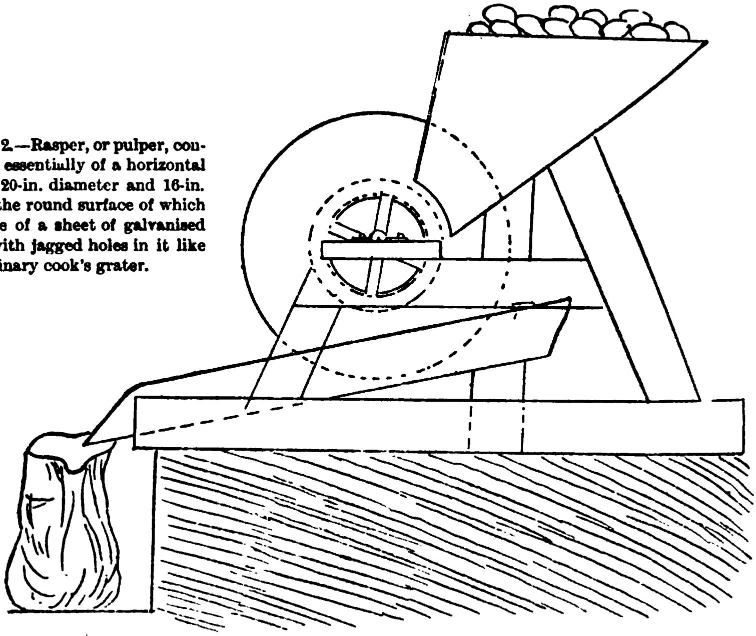


Fig. 2.—Rasper, or pulper, consisting essentially of a horizontal drum, 20-in. diameter and 16-in. wide, the round surface of which is made of a sheet of galvanised iron, with jagged holes in it like an ordinary cook's grater.

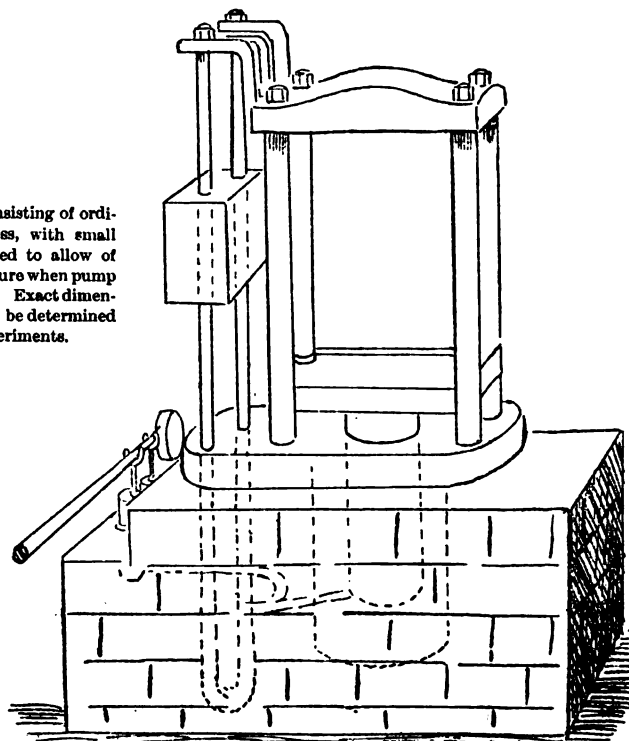


Fig. 3.—Press, consisting of ordinary hydraulic press, with small accumulator attached to allow of continuance of pressure when pump is not being worked. Exact dimensions and power will be determined by this season's experiments.

in sugar-beet cultivation—it has been positively proved in Victoria that good roots with a full percentage of sugar can be grown in Australia, and that if central factories could be established at which growers could deliver the roots (or even the juice extracted locally) in good condition, the industry must surely pay all concerned. Mr. A. N. Pearson, chemist to the Victorian Agricultural Department, has planned a system for extracting juice from the sugar-beet, on the ground. "The machines required are four in

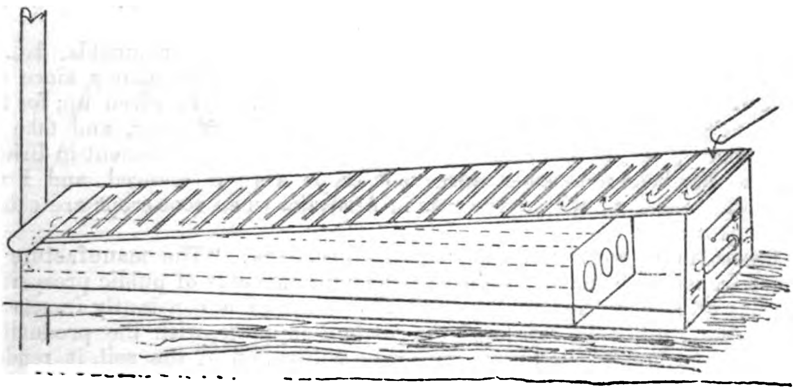


Fig. 4.—Evaporator, consisting of galvanized iron vat, with fire-box and flue-pipes inside for boiling water. This vat is covered over by a sloping evaporating tray, the surface of which is divided by cross-slips into a zig-zag channel.

number. The first for washing the roots (Fig. 1). The second for grating the roots to a pulp (Fig. 2). The third a press for extracting the juice (Fig. 3). The fourth an evaporator (Fig. 4), from out of which the sugar comes, grey or brown, in a half candied condition, in which state it can be carried in bags to the refinery. The total cost of such a plant will not be more than £150, and it would be quite sufficient to manipulate all the beet grown by a number of farmers in any particular district. The Melbourne Sugar Refinery Companies are willing to purchase the raw material prepared according to this plan at a price returning a good profit to the grower."

We can well understand Victoria embarking in this industry, seeing that sugar-cane will not grow in the Colony.

Prospects in New South Wales.

With regard to prospects of beet-root cultivation for sugar in this Colony, I think that farmers in New England will admit that the margin of profit is satisfactory. We have no duty to pay on the home-made article, and there is ample room in these Colonies for more of it, as has been pointed out when speaking of our imports; whilst we should also take into consideration other direct and indirect advantages to be gained from the cultivation of beet. Facts have proved that the cultivation of the sugar-beet and the manufacture of sugar therefrom form a most important industry, to which many countries owe, to a great extent, their prosperity, notably France, Austria, and Germany. It is wise in these days of depression to carefully examine our resources and ascertain to what extent the cultivation of new crops, amongst them sugar-beet, would give farming an impetus in this

Colony. Putting on one side altogether the profits to be obtained from sugar-beet itself, it may be noted that we should reap other advantages in the improved condition of the soil, owing to the more varied cultivation and the introduction of a good rotation crop; our provender for cattle and sheep would be increased, and that in a material very rich in itself; we should be helping the dairy industry and be encouraging the fattening of stock for distant markets in thus improving our stock food supplies. Again, we should be required to use our railways more, be providing more work for the inhabitants, and in many other ways besides those mentioned, be aiding in the material welfare and prosperity of our country.

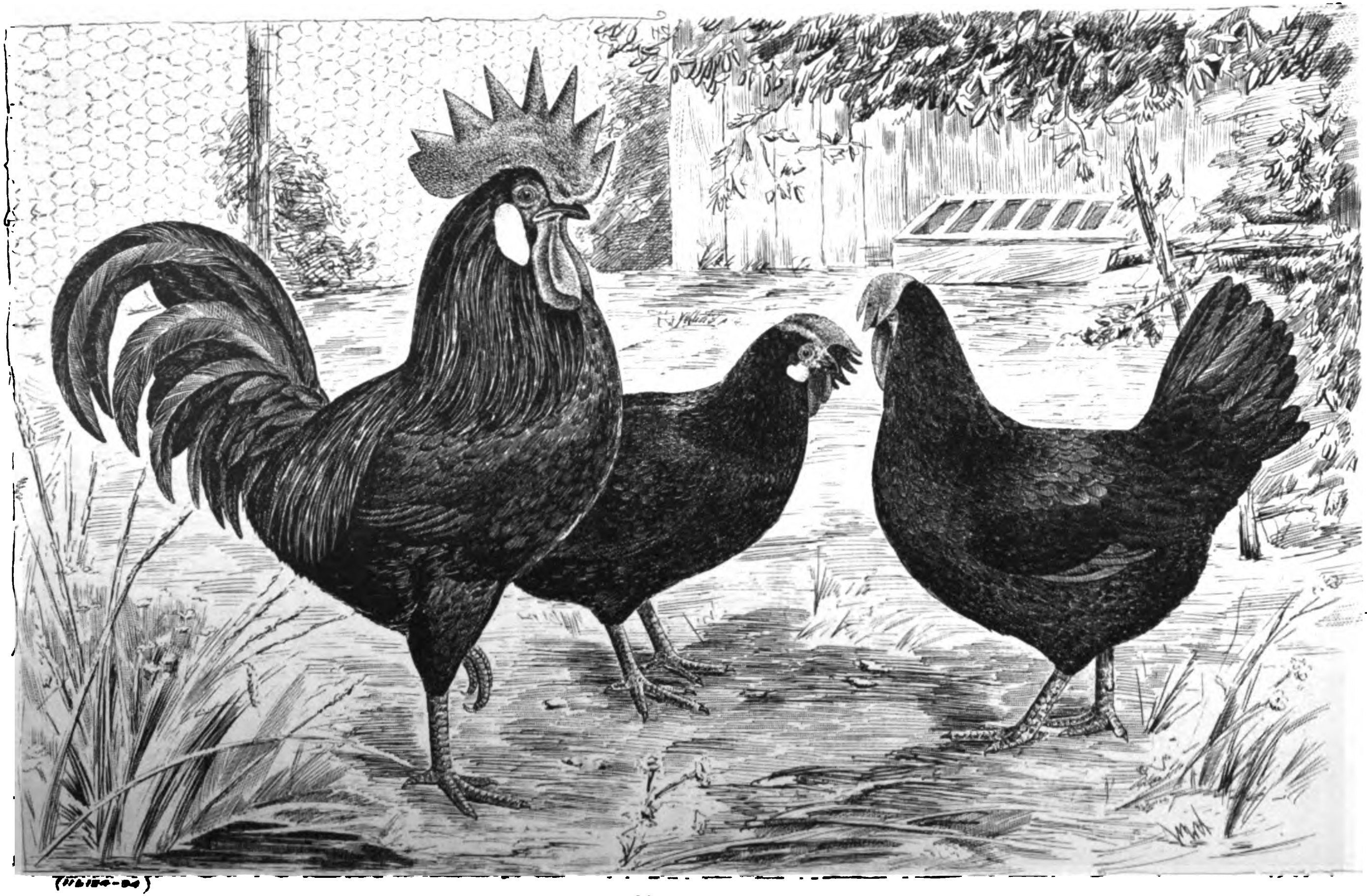
It is very doubtful whether the root crops, turnips, mangolds, &c., of Great Britain are in themselves payable ones; more particularly since the days of ensilage. They are, however, not likely to be given up, for the reason that they constitute the foundation of good farming, and take an important place in the rotation of crops. A great improvement in British farming has been noticeable since root crops were introduced, and I am quite sure the same will be the case in Australia when root crops are extensively grown.

Basset, in his work on sugar manufacture, says: "The manufacture of sugar from beet is one of the most important elements of public prosperity. Resting on agricultural progress and the wants of a constantly increasing population; allied, by reason of the cattle it supports, with the production of meat and bread, based upon improving cultivation of the soil, it renders to modern society the greatest services, at the same time that it attains for itself the highest point of prosperity and glory to which any industry ever had the ambition to aspire."

Other writers agree with the above, and all concur in saying that this industry stands pre-eminent with its beneficent results.

It is not my intention to touch on the cost of erecting factories for the extraction of the sugar. There appears to be a considerable diversity of opinion amongst experts as to the amount of capital necessary. It is generally understood that £100,000 would be required; some have put it as low as £15,000 and some as high as £200,000. The farmers of New England may rest assured that if they prove that their soil and climate are suited to the production of a first-class beet, enterprise will not be wanting to provide capital for extracting the juice and manufacturing the sugar, as has been done by the Colonial Sugar Company in connection with sugar cane. It is well known that when the industry is carried on on a large scale it is much more profitable than when carried on in a small way. Enough has been said to show the suitability of the soil and climate of the New England district to produce good sugar beet. The matter rests entirely with the farmers themselves as to whether they can make this industry a success.

In conclusion, I have to acknowledge my indebtedness in the preparing of this article to the valuable papers that have already appeared in our own *Gazette*, also to Mr. Salatnay, whose papers on the subject appeared in the *Melbourne Age*, September and October, 1893, to Mr. E. Clarke in the *Journal of the Royal Agricultural Society of England*, 1891, and Wave on the Sugar Beet.



MINORCAS

Poultry.

By S. GRAY,
Sub-Editor.

The Minorca Fowl.

The Minorca is a bird of Mediterranean origin, and is well known and highly esteemed on the island after which it is named. It is supposed by some authorities to be the breed from which the white-faced Spanish has been raised. Whether or not this is the case it is a much hardier bird, and, in my opinion, a more useful bird in every way. In addition to being a good layer, it produces the largest egg laid by any fowl known, it being possible to pick out without trouble eggs weighing 3 oz. each. As a table bird it is also more satisfactory than either the Spanish or the Leghorn.

The following description given by Mr. H. Leworthy, of Barnstaple, England, is taken from Lewis Wright's *Book of Poultry*:—"The comb of the cock is very large, straight, and upright, the spikes being very wide at the base and tapering at the points. The wattles are very large and pendulous, the ear-lobe long, and as purely white as a Spanish, but the face is red, with a purple tinge under the eye, the cheeks being very thin. The eye should be a very dark colour, and the beak dark horn. The shoulders are wide, legs short, and carriage rather low. The tail is very large and flowing. The comb of the hen falls over one side of the face, so as almost to conceal the whole of it, and even the bill, otherwise she corresponds closely with the cock, allowing for difference of sex. The plumage of both cock and hen must resemble that of the rook, being a sooty kind of black. The weight of the cock averages about 5½ lb., and of hens about 4½ lb."

Since the above was written considerable improvement has taken place in regard to weight, and it is now possible to obtain cocks weighing 9 lb. and hens 7 lb. In addition to its other good qualities the bird is a hardy one and not difficult to rear. It adapts itself to almost any part of New South Wales from the sea coast, where, of course, it is quite at home, to the warm regions of the interior. In the interior, however, there might be some difficulty in keeping the ear-lobes white and obtaining the very large development of comb and wattle, but this is only of moment where exhibition birds are required, and the provision of plenty of shade would no doubt counteract any such effects of the hot sun. While they are not generally regarded as winter layers, early hatched pullets may be relied upon to contribute a fair quota to the egg-basket in winter, and the year round it is not at all uncommon for a hen to produce from 150 to 180 eggs.

Mr. Wright very commendably adds a word of warning to breeders against the exaggeration of the various points. The points as they appear are quite sufficiently developed, and any exaggeration becomes, in my opinion, unnatural and unsightly. It must not be forgotten, moreover, that any

great development in one direction will probably have a deleterious effect on some other point, and should it be a point of utility which is so effected, it will certainly not be any improvement of the breed.

There was at one time an idea that the Minorca should stand high on the leg, but it is now generally admitted that the typical bird should have legs of medium length, with full breast and body. A little lustre, too, is now generally preferred on the feathers. Dark legs are preferred in the show pen, but, as usual, get lighter with age. The cock should be broad in the skull, or the comb is apt to go over. His comb should be evenly spiked, and of course straight and well finished behind. The lobe is generally described, by those content with a moderate one, as "almond-shaped." The hen's comb should fall well over, but with an arch in front. In cold places the "tips" of the spikes are apt to be frost-bitten, which can, however, be almost always prevented by smearing over occasionally with oil. This keeps water from adhering when the fowl drinks. "We are certain from personal observation," says Mr. Wright, "that too large combs and wattles both spoil the carriage and hinder laying, birds with such not being able to pick up their proper allowance in competition with those more moderately endowed."

The chief breeders in New South Wales are Mr. C. Brown, of Newbridge; Mr. Ambrose Hallen, Toongabbie; Mr. T. Hall, of Fairfield; Mr. J. S. Moller, of Orange; Mr. J. Spratt, of Orange; and Mrs. W. H. Webb, of Bathurst.

The illustration is from a photograph of a pen of birds belonging to Mr. Ambrose Hallen.

The following "Value of Defects in Judging" is taken from Mr. Wright's book:—

Points of Merit.		*Defects to be deducted.*	
A bird perfect in shape, style, colour, and condition to count in points	100	Bad-shaped comb	15
		Ear-lobe folded, wrinkled, or duplicated	8
		White on face	15
		Stain of red on ear-lobe...	12
		Scabs or blemishes on ear-lobe ..	8
		Want of hackle	6
		Squirrel tail	12
		Faults in plumage	12
		Want of size	15
		Want of symmetry	20
		Want of condition	15

Disqualifications.—Cock's comb falling on one side, or hen's not doing so. Combs trimmed, cut, or pierced. Crooked backs or tails, or any other deformity. Any fraudulent trimming, dyeing, or dressing whatever. Legs of any colour but dark-leaden or black, or the occurrence of any coloured feathers in the plumage.

Notes on Insect and Fungous Pests.

By C. T. MUSSON,
Hawkesbury Agricultural College.

Spring Work in the Orchard and Garden.

A sharp look-out should be kept for the appearance of any crop-pests, either insect or fungoid, and on the first sign of such take the necessary steps to prevent them spreading. In all cases of common and ever-present pests early preventive steps should be taken without waiting for their actual appearance. Many crop-pests can, by means of energetic early measures, be preserved from great loss; whilst it may be taken as a safe rule that half-hearted measures do little or no good. There should be no hesitation, and where any doubt exists adopt the safe course of applying such means as are at hand, and make the matter as certain as is possible with us.

Below is a condensed outline of measures that should be carried out in dealing with some of the commoner pests.

Fungi.

Pear.

Leaf Blight.—Following up the winter spray an application of Ammonio-carbonate of copper should be made at intervals. First application just before the flowers expand; a second when bulk of the petals have fallen; and again, say, twice more at intervals of fourteen days.

Apple.

Scab, Cracking, or Black Spot.—Apply the same remedy, and in the same way, as for pear leaf blight.

Mouldy Core.—Caused by the presence of common mould in the core of certain varieties. Infection is brought about by the spores of the fungus, carried by the wind, settling on the eye of the growing fruit, on germinating, the new growth travels down the open pip and starts the trouble. In planting avoid all varieties with open pip-holes, and if the fungus is doing damage spray the trees with ammonio-carbonate of copper immediately on fall of the petals and again ten days later, repeating the application if necessary.

Ripe Rot.—Common rot in apples is caused by a fungus. Common-sense treatment required. Rotten apples should not be allowed to remain on the ground; they should be destroyed by burning or deep burying, burning, however, is always preferable to burying, In gathering, handling, and packing great care should be taken not to bruise the fruit or damage the

skin. Fruit should never be *thrown* into cases or on to ground, but carefully *placed* there. No doubt half the fruit that so rapidly rots when marketed does so through rough handling.

Peach.

Suffers from *leaf-curl* and *rust*. As advised in the winter notes, all stone fruits are very tender and cannot stand the application of fungicides of normal strength. Trials of weak solutions of Ammonio-carbonate of copper or Bordeaux mixture should be made (say, at half strength). Trees so treated, if withstanding the application, have proved to be healthier, and to keep their leaves cleaner than untreated trees. Diseased parts should be cut off and burned.

Apricot.

Trees subject to *shot-hole disease* should, after the winter spray, be treated with one of the remedies mentioned in speaking of the peach; applying the liquid weak and at intervals, following the plan indicated when dealing with pear.

Orange.

A black fungus frequently appears, covering the upper surfaces of the leaves with a soot-like layer. This denotes the presence of certain hemipterous insects (aphis or scale), the fungus only occurring on leaves covered with a sticky, sugary liquid excreted by the insects. Get rid of the insects by applying kerosene emulsion or resin wash and the sooty coating will soon disappear.

Grape Vine.

Oidium is a common disease, appearing as a white mealy coating on the leaves and fruits. Easily kept from damaging the fruit by regular applications of powdered sulphur, dusted on through a piece of cheese-cloth or muslin, of one or two layers, or by means of the sulphur bellows.

Black Spot is a much more difficult disease to cope with. All badly infested shoots should be cut away and burned. Regular applications of Bordeaux mixture should be made until the grapes begin to turn, then Eau Celeste should be used instead, as the lime in the Bordeaux mixture would, if put on as the berries ripen, discolour them, rendering them unsightly, whilst Eau Celeste does not injure their appearance. These remedies following the winter wash with sulphate of iron would, if persevered in, much reduce the pest.

Insects.

Apple.

Codlin Moth.—Wherever this pest occurs it can be kept down if proper steps are taken, namely, regular applications of Paris green, 1 lb. in 200 gallons of water, some flour being added. First application to be made immediately the fruit has set, and continued at intervals of fourteen days, until the fruit commences to change colour. Two bandages of canvas, or twisted straw, should be fastened round the tree trunk, the lower one about 1 foot from the ground, upper one a foot above the first. Every seven or ten days these bandages should be taken off and examined; all grubs and chrysalides found sheltering therein should be carefully destroyed. Fallen apples should not be allowed to lie about. They might be boiled and given to pigs, or buried deep in the ground. All loose bark should be removed.

Mussel Scale.—Scale insects feed upon the sap of the tree, and rob it of nourishment required for its own use. Frequently they occur on the fruit. All scales are difficult to dislodge, but regular treatment should be carried out. Follow up the winter treatment of brushing with some insecticide by applications of kerosene emulsion or resin wash.

American Blight.—In cases of infested trees, the roots may be opened up and treated with hot water, sulphate of iron, or soapsuds. If branches are attacked, brushing with kerosene emulsion or resin wash will reduce the evil. Insects, if below ground, should be prevented from reaching the branches by means of bands, greased at intervals, tied round the tree. Decoction of tomato stems and leaves said to drive away or kill the insect if applied as a spray. Tomato plants grown round the apple trees are said to keep this blight away. Trunks of the trees should be kept clean, all loose bark being taken away.

Hairy Grub.—At Richmond, during 1893, apple trees suffered severely towards the end of summer from the attack of a hairy grub, the larva of a night-flying moth, which destroyed the leaves and pupated in silky cocoons in crevices of the bark, forks of the tree, or any sheltered spot on the trunk. Had these been left we should have allowed the insects to increase greatly. Hand-picking was resorted to, and the trees cleared, all grubs and cocoons being destroyed.

Pear.

Leaf Mite.—If this pest appears, and is likely to give trouble (it lives in small galls on the under surfaces of the leaves), applications of soap and sulphur emulsion or kerosene emulsion should be given at intervals, care being taken that the undersides of the leaves receive the spray.

Peach.

Aphis.—There insects, "green fly," "black aphis," and others, are frequent on stone fruits. They can be got rid of by applying a decoction of Quassia chips and soft soap. Boil 4 oz. of each in a gallon of water for an hour, strain, make up to 4 gallons with warm water, and apply as a liquid spray, either cold or slightly warm, as frequently as found necessary. Two or three applications will usually clear them away.

Fig.

Fig-leaf Beetle.—The larvæ (hairy grubs) attack the leaves, and the full-grown beetle (brown, half an inch long) the young shoots. Apply Paris green, 1 lb. to 150 gallons water, with a little flour added, at intervals of fourteen days, as a liquid spray. If the beetles are plentiful, shake the tree; they fall to the ground, which can then be heavily watered with boiling water from a watering-can. There is no difficulty in preventing serious trouble from this pest if Paris green is regularly applied.

Orange.

Aphis.—This also occurs on lemon and mandarin. Apply kerosene emulsion or resin wash.

Red Scale, *White Louse*, and other scale insects.—All very difficult to dislodge. Regular applications of kerosene emulsion or resin wash. These can be kept up all the year round if necessary, except when trees are in flower. All scales are largely preyed upon by ladybird larvæ, and other predacious insects.

Borers.—The grubs of certain beetles penetrate the branches of orange (and other trees at times). Insert a piece of wire into the holes, twisting it about; examination of the end will show whether the grub has been pierced, if it has it will die; plug the holes with clay. If attack is bad, the parent insects may be prevented from laying their eggs on the trunk or branches by washing the tree with strong kerosene emulsion, carbolic acid and water, or whitewash in which a little kerosene or carbolic acid can be mixed.

Orange Rust Mite.—A small spider mite that punctures the oil-cells of the skin, causing the oil to exude and oranges to become discoloured, spoiling their appearance, and consequently damaging prospects of sale. Readily kept down, if on its appearance, and at regular intervals, the oranges are sprayed with soap and sulphur emulsion.

Grubs.—Caterpillars of several species of butterflies attack this plant, living on the leaves. Paris green may be applied to poison them, but we have found hand-picking the most satisfactory.

Grape Vine.

Vine Moth.—A black, yellow, and red grub, the larva of a handsome moth, of the same colours, does a great amount of damage to vines. If not attended to regularly the leaves are completely stripped away. Paris green, 1 lb. to 150 gallons, may be applied, but if the vines are few in number daily hand-picking is the best plan. This grub is extensively destroyed here by a plant bug, a brown, flat, angular insect about ¾ of an inch in length.

Cabbage.

Cabbage Moth.—A small white grub, that of the common cabbage moth, damages large numbers and pupates in a silky cocoon in hollow places on the leaves. If the plants can be brought safely through the first half of their lives without serious damage they reach maturity in fair condition. One of the best remedies is "tar-water" applied to the plants when quite young and at intervals. Boil 1 lb. coal tar in 2 gallons water, and dilute with water to 100 gallons for use. Fine ashes or powdered lime are also distasteful to the grubs.

Potatoes.

Attacked, but not seriously damaged, by the 28-spot ladybird, which feeds upon the leaves. A large form, belonging to a section of that generally useful group, which unfortunately habitually feeds on plants.

Hardly worth the trouble of applying a remedy. Paris green, however, may be used in case attack is really serious.

Potato Moth.—The grub of this small moth does considerable damage, both to the growing plant and the stored tubers. Difficult to reach, consequently remedies must be preventive. Stored tubers showing signs of its presence should be boiled and given to the pigs. Before storing tubers, they may be washed in a weak solution of alum or sulphuric acid or corrosive sublimate. Sawdust spread over tubers prevents moths reaching them to lay their eggs. Infected tubers should not be planted.

Tobacco.

The seed capsules are penetrated by the *army worm* (grub of the maize moth), which feeds upon the young seeds, boring into the capsule, and allowing rain to penetrate, causes all contained seeds to be lost. Regular hand-picking is the only remedy once the grubs attack.

Also attacked by the *potato moth*, which lays its eggs thereon, the grubs, on hatching, burrowing into lower leaves and stem near the ground, often causing the latter to snap under pressure of the wind, the whole plant falling to the ground. Clear away and destroy the attacked leaves. Never plant on or near ground where potatoes have been growing if they have been attacked by the same pest.

Remarks.

If the steps herein advised are persevered in throughout the period when attack is dangerous, growers will, without doubt, reap the benefit of larger, cleaner crops, whilst every year under such a system of "preventive measures applied" the loss suffered would be smaller.

The measures must be thoroughly carried out to be efficient, and the general rules mentioned in last month's remarks on "winter work," with reference to the application of sprays, must be carefully followed.

Experience soon shows how much liquid will be required. One gallon should be sufficient for at least six medium-sized fruit-trees, possibly more. The cost for materials and labour is trifling. Compared with the result, certainly not more than 3d. per tree for four sprays if 150 trees are treated, and if large numbers are operated on, 1½d. per tree would cover it, whilst an increase of good fruit of only 5 per cent. would give a handsome return on the outlay. Machines must, of course, be provided, and labour costs money. The most useful forms of spray-pump are, a light one to carry about like the Vermorel, which will take 3 gallons, and a larger one on wheels, having a brass delivery tube not less than 4 feet long attached to a short rubber tube giving a full stretch of (say) 8 feet. The Vermorel should not be used when kerosene is applied. A small hand syringe, having nozzles for vertical and horizontal discharge, is very useful. The "Stott" instrument is a good one.

There is not the slightest danger of poisoning from eating sprayed fruit, consequently there need be no hesitation in trying to save our crops by its use. I shall have something to say on this point in a later number.

Note.

(1.) In making up all sprays, wooden or earthenware utensils should be used (not iron).
(2.) All liquids should be kept well stirred, as the useful matters are generally in suspension.
(3.) Plants must not be sprayed when in flower.
(4.) Beware of spoiling appearance of the fruit as it ripens.
(5.) Paris green is very poisonous, and should be kept out of the way of children.

How to make the Liquids.

Ammonio-carbonate of Copper.—To make 30 gallons:—(*a*) dissolve 2 lb. copper sulphate in hot water; (*b*) dissolve in a separate vessel 2½ lb. sodium carbonate in hot water. When thoroughly dissolved mix the two slowly, and add 1½ pint strong ammonia, dilute to 30 gallons with water.

Eau Celeste.—To make 22 gallons:—Dissolve 1 lb. copper sulphate in hot water, make up to 22 gallons with water, and just before using add 1½ pint of strong ammonia.

Bordeaux Mixture.—To make 22 gallons:—(*a*) Dissolve 4 lb. copper sulphate in hot water; (*b*) dissolve in a separate vessel 2 lb. fresh lime in hot water. When cool mix the two slowly, pouring (*b*) into (*a*), filter, and make up to 22 gallons with water. A mixture of half this strength should be tried.

Paris Green.—1 oz. Paris green to every 10 gallons water is equal to 1 lb. to 160 gallons; four-fifths of an ounce to 10 gallons equals 1 lb. to 200 gallons. Mix the Paris green with a little water, gradually adding more water. Mix a little flour up, 4 oz. to every oz. of Paris green, in the same way in a separate vessel; when both liquids are sufficiently thin they can be mixed and made up the required quantity.

Kerosene Emulsion.—To make 15 gallons:—Proportion, 1 part kerosene to 14 water. Dissolve ¼ lb. soft soap in boiling water, and, when thoroughly dissolved, pour it into a vessel containing 1 gallon kerosene; churn the liquid well for ten minutes by means of a garden syringe. This produces a creamy-looking liquid, which must be diluted for use to 15 gallons with cold water. More soap may be used if desired.

Resin Compound.—To make 12 gallons:—Boil together in a gallon of water ¾ lb. washing soda and 1 lb. resin, stirring the liquid occasionally; when thoroughly dissolved add a little water from time to time, keeping hot. For use, make up to 12 gallons by adding hot water slowly. Apply when nearly cold.

Soap and Sulphur Emulsion.—To make 50 gallons:—Boil 1 lb. sulphur in a gallon of water for an hour, add 1 lb. of whale-oil soap (or even soft soap), and mix thoroughly. Dilute to 50 gallons for use.

Combined Spray.—One spray may be made to serve for both insects and fungi, by adding a little Paris green to one of the fungicides, say Bordeaux mixture, in proportion of 1 lb. Paris green to 200 gallons of the liquid.

Analysis of Tumut Tobacco.

By F. B. GUTHRIE,
Departmental Chemist.

THE following is the result of analyses of two samples of leaf grown a Tumut, the one a light, the other a dark leaf:—

	Light leaf.	Dark lea
Water	13·03	14·74
Ash	14·43	13·41
Nicotine	2·40	4·10
Total nitrogen	4·88	4·75

Analysis of Ash.

Sand and charcoal	11·46	5·39
Carbonic acid	16·58	22·27

Composition of pure Ash, exclusive of sand, charcoal, and carbonic acid.

Oxides of iron and alumina (Fe_2O_3 & Al_2O_3)	1·68	1·01
Lime (CaO)	39·05	43·33
Magnesia (MgO)	10·15	8·66
Potash (K_2O)	17·28	19·32
Soda (Na_2O)	9·95	11·43
Chlorine (Cl)	2·19	2·25
Silica (SiO_2)	4·88	2·28
Sulphuric acid (SO_3)	7·90	7·13
Phosphoric acid (P_2O_5)	7·81	5·94
	100·89	101·35
Deduct oxygen equivalent for chlorine ...	·49	·51
	100·40	100·84
Alkalinity calculated as potassium carbonate	9·02	10·63

It is of interest to note that, although the plants had been sprayed with Paris Green three weeks before picking, no trace of this compound is to be found in the dry leaf.

The following table taken from Thorpe's Dictionary of applied Chemistry, article "Tobacco," gives the composition of the ash of some typical American varieties of leaf:—

	Virginia. — Uncured; for plug Tobacco.	Virginia. — Fire-cured; low grade.	Tennessee. — Fire-cured; for German and English markets.	Kentucky. — Air-cured; for plug Tobacco.
Total ash in dried leaves	14·29	17·42	19·21	21·85
Ash exclusive of sand and CO_2 ...	12·41	13·36	14·37	16·06
Analyses.				
Potash	34·16	26·55	33·15	39·51
Soda...	0·26	0·22	0·15	0·86
Lime...	31·76	36·96	36·48	39·80
Magnesia	7·91	11·51	11·85	5·34
Ferric oxide	0·58	0·95	0·51	1·56
Alumina	1·22	1·81	0·95	0·51
Manganous oxide	0·00	0·00	0·25	0·13
Phosphoric anhydride	3·81	3·23	4·42	6·09
Sulphuric ,, ...	4·99	4·27	6·16	4·52
Silica	1·39	3·29	3·42	1·20
Chlorine	13·92	11·21	2·66	0·48
	100·00	100·00	100·00	100·00
Nicotine	3·26	4·30	5·29	3·12

Of the Tumut leaf the light sample, owing to imperfect cultivation, does not quite fairly represent the nature of the leaf under proper conditions. The following remarks apply, therefore, more particularly to the dark leaf.

Of the American varieties above recorded the Tumut leaf most nearly approaches the Tennessee product in general characteristics, and as it is with this and similar leaf that it would be brought into competition, a brief comparison of these two analyses will be of value. The most striking difference in the chemical composition of these tobaccos is the small proportion of potash present in the Tumut leaf, which amounts to about half that in the American, its place having been largely taken by soda. This point is of importance as influencing the combustibility of the tobacco, which is said to depend principally upon the amount of potash in combination with organic acids, such as malic and citric acids in the leaf. The presence of soda, though unusual in the quantity present in the Australian leaf, is not actually prejudicial to the combustibility of the tobacco. A high ash, rich in lime and potash, and a high alkalinity are indications of a good burning tobacco. The substances detrimental in quantity to the burning quality are sulphuric acid, chlorine, and phosphoric acid. Lime is well represented in the Australian tobacco, and the proportions of the injurious ingredients above-named compare fairly well with the American samples. The alkalinity of the ash, which is due to the conversion of the potash and soda compounds in the leaf into carbonates on burning, is usually considered a factor of special importance with reference to the combustibility of the tobacco. It is not given in the American analyses, but a comparison with other analyses shows that the alkalinity in the samples of Tumut leaf are below the average.

The following table, compiled from experiments by A. Mayer (Land Versuchs Stat. 38, 127), shows very clearly the influence of the presence of different proportions of potash, chlorine, and alkalinity upon the combustibility of the tobacco:—

Tobacco.	Ash.	Calculated in Ash.		
		Chlorine.	Potash.	Alkalinity calculated as K^2CO^3.
1. Good	20·5	7·3	28·8	23·9
2. Sufficiently good (light ash)	20·8	2·4	27·8	32·7
3. Sufficiently good	22·5	3·1	29·3	24·4
4. Sufficiently good (grey ash)	17·7	6·8	44·6	23·1
5. Bad	18·5	17·8	24·8	2·7

The principal defect in the Tumut leaf, as indicated by analysis, is its deficiency in potash, and the replacement of this substance to a large extent by soda. This is traceable in the first place to the nature of the soil, but principally to the absence of proper manuring. The soil on which this was grown is a fairly rich alluvial, but it is questionable whether any soil contains potash (which is the manurial ingredient most largely demanded by the tobacco crop) in quantities sufficient to dispense with plentiful manuring.

Manuring.

Tobacco is one of the crops that require pretty heavy manuring, more particularly of potash. Of the different potash-salts, the sulphate is the one which gives the best results. Manures containing chlorides are to be avoided—such as potassium chloride and kainit, as chlorides are found to be taken up by the plant in considerable quantity when such manures are used.

An average crop of tobacco removes from the soil 118 lb. potash per acre, 22½ lb. phosphoric acid, and 82 lb. nitrogen. This quantity of potash will be provided by 2½ cwt. sulphate of potash per acre, the phosphoric acid by 2 cwt. superphosphate, and the nitrogen by 4 cwt. sulphate of ammonia; so that a mixture of the above ingredients will supply all the requirements of the crop except lime, and is of course in excess of the quantities actually necessary for the crop, which depend upon the proportions already present in an available form in the soil. Lime is probably best supplied in the form of gypsum; and, as superphosphates contain a considerable proportion of gypsum, a small additional dressing will probably be sufficient. The Tumut soils are, moreover, largely derived from limestone rocks, and the large proportion of lime in the ash of the leaf indicates that only comparatively small doses of lime will be needed.

As tobacco only occupies the ground for three months, it is important that its food should be presented to it in as soluble a form as possible in order that it may avail itself of it most effectually in the limited time at its disposal. Hence, such manures as superphosphates are to be preferred to the more slowly acting bone-dust. Excessive quantities of nitrogenous manures are to be avoided, as they are said to promote a coarse leaf. Thorough cultivation is also an essential to success.

Exhaustion of the Soil by Tobacco.

It will seen from the above analysis, and especially from the large percentage of ash, that tobacco removes a larger proportion of the mineral constituents of the soil than most of the cultivated crops. It is, therefore, said to be a very exhausting crop. This is no doubt true, and it is also true that heavy manuring is essential for its successful cultivation; but a study of the following table will show that some of the common farm crops make nearly or quite as stringent demands upon the soil as does the tobacco crop. The numbers are taken from Warington's Chemistry.

Amount of different constituents contained in an average crop of the following, in pounds per acre:—

	Tobacco crop of 1,260 lb. dry leaf and 1,100 lb. dry stalk.			Mangels. Root, 22 tons.	Turnips. Root, 17 tons.	Wheat. Grain, 30 bushels.	Beans. Grain, 30 bushels.	Potatoes. Tubers, 6 tons.
	Leaves.	Stalks.	Total.					
Sulphuric acid	14	3	17	35	52	20	23	6½
Potash	71	47	118	300	149	29	67	76½
Soda	5	10	15	119	24½	2½	2	4
Lime	73	15	88	43	74	9	29	3½
Magnesia	17	2	19	42½	9½	7	10	6½
Phosphoric acid ...	7½	15	22½	53	33	21	29	21½
Chlorine	...	...	...	83	22	2½	5½	4½
Silica	...	...	...	18	7½	97	7	2½
Nitrogen	49	33	82	138	112	48	106	47
Total	206	95	383	680	364	172	157	127

An average crop of tobacco removes about the same amount of mineral matter from the soil as a crop of turnips, and not much more than half the quantity removed by a mangel-crop. The proportion of potash, it will also be seen, is very much lower than in either of these crops. It must also be taken into consideration that the stalks are left on the land, whereby about one-third of the fertilising material is returned for the use of the succeeding crop, the proportion thus returned in the case of root-crops being very much smaller. The tobacco crop also occupies the ground for only three months of the year, so that after it is stripped the land can be utilised for other purposes. Mangels and turnips keep possession of the ground twice as long, and wheat for a longer period still.

Practical Vegetable Growing.

Directions for the Month of October.

All the recently sown seeds should come up soon, now that the soil is becoming warm, and especially so where there has been rain. Vegetables that have been planted out should also be making fine growth. The plants should be kept quite free from weeds, either by hand or by the frequent use of a hoe. If the weather should be very dry, and it is not improbable that dry, hot winds may blow in some parts of the country, a thick mulch of decayed or partly decayed leaves, or else cow-dung, horse-dung, dried grass, or sea-weed where it can be obtained, should be spread round the plants and between the rows, so as to prevent the moisture in the ground from evaporating, and to keep the soil cool. If no kind of mulch can be obtained, the surface of the soil should be kept well cultivated. But there will, most probably, be abundance of cow or horse dung procurable on every farm, quite sufficient to cover the whole vegetable garden. The use of weak liquid manure made from the droppings of animals—cows, horses, fowls, or sheep—soaked in plenty of water and applied frequently, will ensure a good supply of vegetables, even in a dry season.

In gardens situated near the coast where sea-weed can be easily obtained, it is well worth obtaining to apply as a manure. It can be used as a litter for farm animals, for it will rot much better if it be saturated with urine. Sea-weed not infrequently contains a good percentage of potash, an important constituent of plants of all kinds.

Beans, French or Kidney dwarfs.—This is one of the most prolific and useful of vegetables during the summer months. It may be sown now in nearly all parts of the Colony. It will thrive in almost any kind of soil, provided the soil be thoroughly well drained and well manured. It is one of the plants known as "lime-loving plants," for it is exceedingly fond of lime. It will, therefore, be apparent to everyone that an application of lime will be of benefit to beans, and the same may be said of peas, broad-beans, and leguminous plants generally, such as clovers, vetches, lucerne, &c. These kinds of plants derive but little benefit from manures containing a large proportion of nitrogen or ammonia, such as blood manure, nitrate of soda, and sulphate of ammonia. It would be simple waste to apply such manures alone for the above kinds of vegetables. If artificial or chemical manures, as they are termed, are to be used, then apply superphosphate of lime, lime, sulphate of lime, or gypsum, combined with potash manure, such as kainit, or wood ashes. Whilst on the subject of manures, it may be well to mention that it is always safe to use rotten stable manure for vegetables, which may be said to be the droppings of all kinds of animals, mixed up with litter. The droppings of fowls makes a very useful manure, particularly if used dissolved in plenty of water and applied in a liquid form. Stable or farm-yard manure

had better be used in a well-rotted condition for vegetables, for then they are not liable to become too rank. Pig manure has the objection of imparting a disagreeable odour to vegetables, especially to those used for thin leaves, such as cabbages. Dung should always be kept under cover, or else the best part of it is most likely to be washed away by rains. Dig up your ground well for French beans, and keep the surface as level as you can. Make drills about 4 inches deep, 2 feet 6 inches or 3 feet apart, and drop the beans along the bottom of the drills about from 4 to 8 inches apart. The plants will need a good deal of space, and it is a mistake to sow the seed too thick; it is simply a waste of seed. The plants will come into bearing, if the weather is warm and favourable, in about six weeks after the seed is sown, and will continue to bear for a considerable time, if every bean is pulled before the seeds mature. It would not be advisable to sow more than about 20 feet or so of a row in length at a time, say, about every two weeks, but this is a matter that must be left to each one's requirements or judgment. All that need be said is that this is one of the most reliable and wholesome of vegetables for the summer, and it is better to have an over than an under supply, for it is quite probable that neighbours who cannot grow vegetables for themselves would gladly purchase any surplus.

Beans Kidney, runners.—These may be managed in the same manner as the dwarfs, but the seeds had better be sown wider apart. They will need the support of poles, or anything else that will support them. For general purposes in small gardens it will be as well to grow only the dwarf varieties.

Bean, Lima.—If seeds were not sown last month this should be done immediately. There is a dwarf as well as a tall growing variety. The latter bears the largest beans.

Beet, red.—Sow a little seed of this good vegetable in rows about 18 inches apart. When the seeds come up and the plants are strong, thin them out gradually until you have strong plants standing about 9 inches from each other. The ground should be dug deep, but should not be freshly manured. Small clean medium-sized beets are to be preferred to those of a larger size. Badly-shaped and forked roots should be condemned.

Beet, silver.—Is used for the leaves only. Sow a little seed in heavily manured ground. A few plants will be sufficient for an ordiuary sized family.

Cabbage.—Sow a little seed in drills in a seed-bed. Plant out any strong plants that may be available, and do this with care. The customary method of dealing with young cabbages is to pull them out when required, in the roughest manner possible. In the first place the seed is sown broadcast very thick, and the plants grow into spindly looking stalks with a few leaves on the tops. The proper and most effective way to manage the cabbage is to do the work well from the start. Sow in a well-prepared seed-bed made as level as possible, with the surface made very fine; then make little shallow drills with your finger about 2 inches apart and sow the seed very thinly along the drills, and cover carefully with fine soil. Water occasionally, and if the weather is very dry spread a thin mulch of finely broken up dung over the bed. When the plants come up and are large enough to handle, move them carefully to another bed, lifting each plant with a trowel, or old worn out table-knife, without breaking the roots. Plant the seedlings about 4 or 5 inches apart, and they will soon become little pictures if properly looked after. They may be moved to a richly manured bed, at convenience, to grow

into the best of cabbages. When moving do not break the roots and do the work well. Although the cabbage is very hardy and will stand as much ill-treatment as any vegetable, it will respond to and repay care. All gardening work should be done with care, and plants should ever be treated as living things. The sooner the cultivators of the soil can comprehend that proper food and proper management are absolutely necessary for the proper development of the commonest of vegetables, the sooner will they attain success.

Cauliflower.—Sow a little seed and manage the plants as advised for the cabbage. Cultivate the ground with a hoe between the rows of cauliflowers as well as cabbage, and all members of the same class of vegetables.

Carrot.—Sow a few rows or drills about 1 foot or 18 inches apart. Take care to separate the seeds by rubbing them well before sowing, as they are covered with little hooks which cause them to stick together. The carrot-seed takes a long time to come up, so the rows must be kept well weeded and clean, but do not mistake the young carrots for weeds, for they are very small and delicate when they first appear above ground. The variety known as the Improved Intermediate is one of the best to grow. The Early Short Horn is also a very useful carrot. The ground should be dug deep, but it will not be advisable to apply fresh manure. It had better follow some vegetable like the cabbage for which the ground had been heavily manured.

Celery.—Prepare some ground by heavily manuring and well digging, and when some of the best seedlings are ready, transplant them from the seed-bed. The usual method to grow celery is to dig trenches about a foot to 18 inches wide and about a foot deep, heaping up the soil on either side. Manure is dug into the bottom of the trench, and the seedlings are planted. When full grown or nearly so the soil from the trenches is drawn round the plants to make the stalks white and tender. The trouble of digging out trenches is not absolutely necessary, and it is much easier to grow the best of celery on the flat, or in slight depressions, so that water and liquid manure can be easily applied when necessary. Celery requires plenty of water, but the ground should be well drained. When grown on the flat the stalks may be blanched or made white by placing boards on each side, or anything else that will keep away the light.

Cucumber.—Prepare a bed by digging the ground deep, by draining it well, and by applying a good dressing of manure, unless the soil is rich enough without it, as may be the case on some farms. Sow six or eight seeds within a few inches of each other, in a clump, as it were; and about 6 feet distant put in another "clump," and so on until your bed is planted. When the seeds come up and the plants are strong thin out all but two or at most three plants. If necessary, those you thin out can be moved carefully and planted in another bed, or they may be required to fill up misses. Water the plants before they are moved, and again when planted.

Cress and Mustard.—The seeds of these salad plants are generally sown together. They are wholesome and useful vegetables to eat in a green state, and a few seeds should be sown occasionally to keep up a supply. Use a good dressing of rotted manure and mix it well up with the soil. Mustard and cress are about the easiest of vegetables to grow.

Capsicum or Chilli.—This is also known sometimes as pepper, for the pods when dried and ground up are known as Cayenne pepper. There are many varieties, some bearing large, others very small pods. The small or bird's eye chillies are frequently used to flavour vinegar by half filling a pickle bottle with the pods and filling up with vinegar. These are the best

for Cayenne pepper. The plant will succeed in almost any kind of soil in warm situations, if it be heavily manured. The seed should be sown in a box or pot, or in a seed-bed, and the young capsicums afterwards planted out about 3 feet apart.

Egg plant.—Sow in the same manner as the above and afterwards transplant. This vegetable requires a very warm situation. It is questionable whether more than a few plants of it are worth growing. The fruit is very ornamental.

Kohl rabi.—or turnip rooted cabbage. A few plants are worth trying. It is not advisable to grow it to any extent until it is ascertained that the family cares for it. Sow and plant as for cabbage.

Leek.—This is a most useful and wholesome kind of vegetable, and worth growing to a considerable extent. The seed should be sown on a small bed prepared as for other seeds. The surface should be made fine, and the seeds should be sown in rows on the surface and lightly covered with soil, and pressed down with a board or back of a spade. When the young plants are strong prick out as recommended for young cabbages, and when they have attained some size plant out into richly-manured ground. Make a hole with a dibber about 6 or 8 inches deep, and set the leek in this, filling in fine soil very lightly around the stem. Or make trenches like celery trenches, and earth up the plants when they grow to nearly their full size in order to blanch or make white the stems. Water often, and apply abundance of liquid manure.

Lettuce.—This is a useful plant for summer use, but unfortunately it is apt to run quickly to seed during the warm weather. The best kind for this time of the year to sow is one of the Drumhead class. Manure well, and use liquid manure frequently to keep the plants growing fast. Sow the seeds in a seed-bed, and when moving the plants be particularly careful not to break the roots.

Melon, Rock and Water.—Prepare the ground as recommended for the cucumber, and sow the seed in the same way. The watermelons should be sown wider apart than the cucumbers or rock melons.

Okra.—Plant out from the seed-bed any young plants that are strong enough, 2 or 3 feet apart. Sow a little seed.

Onion.—Sow a little seed. Any plants that are growing should be kept carefully weeded, and spread a dressing of soot and salt about them. Half soot and half salt.

Parsnip.—Sow a little seed in rows about 2 feet apart. The ground should be dug as deep as possible.

Peas.—A row or two may be sown. The peas will succeed best, during the summer, in the coolest parts of the Colony.

Potato.—Plant out a few rows of medium-sized whole potatoes. Use plenty of manure unless the soil of the garden is sufficiently rich without it.

Pumpkin.—Sow a few seeds of the ironbark variety if it can be obtained. Prepare the ground well and use manure liberally. Sow the seed in clumps about 8 feet apart, and thin out the plants to two or three when they are strong enough.

Radish.—A few radishes well grown are always useful. It would be as well not to sow too much seed at a time as the roots soon deteriorate. Apply well-rotted manure, and dig up the soil well and make it fine. Sow in rows, and thin out the plants as soon as the second leaves appear.

Rosella.—This is a kind of Hibiscus, which will succeed only in the warmest parts of the Colony. The portion of the plant used is the flower calyx. It makes an excellent and most beautiful coloured preserve. The seed shall be sown in pots or boxes, and the plants afterwards transplanted to well-manured ground.

Rhubarb.—A little seed may be sown in a box or seed-pan, but it is rather late in the season.

Tomato.—Plant out largely from the seed-bed or sow seeds if this has not yet been done. Make some kind of support for the plants to be tied to, so as to keep them off the ground as much as possible. There is no end to the varieties of tomatoes, yellow and red, large and small. The medium-sized and the small are generally the best flavoured, and are on that account to be preferred to the large and handsome kinds. No vegetable garden should be without a few plants.

Turnip.—A little seed may be sown on well-manured ground in drills.

Vegetable-marrow and Squash.—Sow seeds on ground that shall be prepared in the same way as that recommended for cucumbers.

Orchard Notes for October.

In the colder districts of the Colony the notes previously given for September will apply to the earlier part of October, particularly the notes relating to the extermination of insect and fungus pests, such as the scab on the apple, pear, and apricot, and the codling moth in the apples and pears. For either of the scab diseases the best remedy to use is the Bordeaux mixture, full particulars for making which are given in the September Notes. The first application should have been given just before the buds burst, and the second spraying should be given just as the fruit is setting. In the case of apples or pears that have been sprayed with Bordeaux mixture to destroy the scab fungus (*Fusicladium*), where codling moth is also prevalent, Paris green should be added to the Bordeaux mixture at the second spraying, using 1 lb. of Paris green to every 160 gallons of Bordeaux mixture. This will result in killing two birds with one stone, as the Bordeaux mixture prevents scab and the Paris green destroys the codling moth.

The addition of Paris green to the Bordeaux mixture renders the mixture a strong poison for all leaf-eating insects, so that where caterpillars of any kind, or any kind of leaf-eating beetles or other foliage-destroying insects are troublesome, it pays well to use it, as all such insects are thus very easily and rapidly destroyed.

Should, however, such insects be troublesome, and it is not necessary to use the Bordeaux mixture, then Paris green used alone will prove a very cheap and efficient remedy.

During the month look after red spiders, and as soon as the young insects hatch out from the eggs destroy them either by spraying the trees with resin and soda wash or by well sulphuring the trees with a Vermorel or other knapsack sulphur-distributor. Also watch the mussel-shell scales carefully, to see when the young scales emerge from the mother scales, when they are easily destroyed by spraying with resin and soda. The greedy scales of the pear also hatch out during the month, and are similarly treated. The scales on citrus fruit should be destroyed whenever found, of course taking care not to spray when the tree is in full bloom. Where the rust mite or Maori is present, the fruit, when about the size of marbles, should be sprayed with soft soap and sulphur, or fine sulphur may be distributed all over the trees with a knapsack sulphurer. Watch the oranges carefully, and see if they are at all attacked by a small weevil, which eats portions of the rinds of the young fruit, the part injured becoming covered in time with a scaly scab which greatly disfigures the fruit. Where these insects are numerous try spraying with Paris green, and, in order to prevent the scab on the fruit, spray with ammonia carbonate of copper. These two remedies can be used together.

Young trees require considerable attention during the month, as, by the judicious pinching back of laterals, the main limbs can be covered with fruit-spurs, and the energies of the trees will be devoted to growing strong main limbs instead of a lot of laterals, which would in any case have to be cut away the next winter's pruning, and then you get a long bare limb with few, if any, fruit-spurs on it. All grafts should be carefully looked after, and all shoots, except the one left to form the future branch or tree, should be removed. Buds should also be attended to, and no suckers should be allowed to start from below the bud. If the bud is growing crooked, then it should be tied to a stake and kept upright. Where grafts are put on old or large trees that it has been necessary to work over, then care will have to be taken that the vigorous growth of the graft does not cause it to be blown off by heavy winds or broken off by heavy birds alighting on it. To prevent this it is a good plan to lash a stout stick firmly to the limb that has been grafted, on the opposite side of the limb from the graft. The stick should be allowed to extend a foot or more beyond the insertion of the graft, and the young growth can be tied to the portion extending and be thus saved from injury. Keep the orchard well cultivated and free from all weeds or other rubbish. In the drier and warmer parts of the Colony too much care cannot be devoted to cultivation during this and the three following months, as (as previously stated in these notes) the success of fruit-growing in the drier districts of the Colony depends mainly, if not entirely, on the retention of the necessary moisture in the soil, and this can only be done by thorough and systematic cultivation—stirring, not turning the soil. Where available, citrus-trees should receive a good mulch of leaf-mould or bush-scrapings, as a good mulch tends to retain moisture in the soil, and also checks the growth of weeds round the trees.

General Notes.

Condensed Milk.

Mr. E. Clarence Wood, Science Master of the Hawkesbury Agricultural College, recently paid a visit to the North Coast District for the purpose of advising several dairy companies in the matter of making condensed milk.

Much enthusiasm exists amongst dairy farmers in their desire to secure a large and lucrative business at present entirely carried on by outsiders. Large sums of money are paid away annually to foreign countries for this article, notwithstanding the fact that we have as good, if not better, opportunities for its local production. Up to the present, however, no colonial firm has met with any commercial success, for reasons which probably could be explained, and in future obviated, and there are very many that are daunted by fears of failure, as has been the case in perhaps more than one instance previously. Without a doubt the cause of such premature failure in the enterprise has been incompetent management either in the process of manufacture or the business organisations—perhaps in both. The cost of production of milk is not greater here than elsewhere, and there are large districts in the centres of which condensed milk factories would be very profitable if established. There are no objections whatever in respect of the quality of the milk or pasturage, as compared with that of other countries, as not a few people are disposed to think. Labour may be dearer, but there is not the expense of export, and it is very significant that in the less remunerative industry of butter-making we are supplying the English and even the Continental markets.

One thing should especially be borne in mind by such as may contemplate the enterprise, viz., that the plant should be established in such a locality that milk may be supplied for condensation in as fresh a condition as possible, and without having been churned up, as would be the case after long journeys over rough roads. Very much depends on this, as also upon cleanliness and careful supervision, for the operations in themselves are very simple and easy of management.

The Climatic and National Economic Influence of Forests.

J. Nisbet, in *Nature*, 25th January, 1894, sums up our present knowledge of the actual climatic effects of forests in a most interesting article, from which we extract the following notes:—

1. *As regards Atmospheric Temperature.*—Observations prove that the immediate action of forests is to modify the daily maxima and minima of atmospheric temperature. This modification of the extremes of temperature, which are bad for man and animals and for agricultural operations, is of great importance, since places once fertile are now little better than barren wastes in consequence of the reckless denudation of forest. Density of foliage, geographical position, and exposure to winds will, of course, modify the results.

2. *As regards Soil Temperature.*—Observations made concerning this point go to prove that forests growing in close canopy exert considerable influence in equalising the soil

temperature throughout the year. In countries with warm summers the reduction of soil temperature by means of forest growth is considerable and with a decidedly beneficial result.

3. *As regards the Degree of Atmospheric Humidity.*—As regards the absolute humidity of the air, forests would seem to have no appreciable climatic effect, although the air in forests is in many cases more humid than air in the open.

4. *As regards the Precipitation of Aqueous Vapour.*—It has been shown that the atmosphere within forests is cooler than in the open, and that the temperature of the trees themselves, especially in summer, is lower than the air surrounding them. Consequently woodlands act as condensers of atmospheric moisture, also increasing the humidity of the air by transpiration from the leaves. In Germany the readings at 192 points of observation show that at high altitudes large extents of forest may considerably increase the local rainfall, whilst the mechanical action of rains on the surface soil is very much modified in consequence of the trees intercepting a considerable proportion of the precipitations. Opinions, it should be stated, differ as to the general effects of denuding land of trees or of tree-planting in tropical countries.

5, *As regards Evaporation of Soil Moisture.*—Forests retard soil evaporation by reason of their general low temperature and the protection they afford against the sun's rays and the action of winds. Wherever observations have been taken it is found that the amount of evaporation is much greater in the open than in the forest. It is also found that the amount of evaporation depends on the class of trees in the forest. Such as have dense foliage would act much more energetically in this matter than would open fine-foliaged trees. The action of forests, therefore, is to retain in the soil a large proportion of the rainfall or of the moisture arising from the melting of snows, which, by percolation to the lower layers and the subsoil, tends to feed the streams perennially, and to maintain a constant supply of moisture, without which trees could not derive their requisite food supplies from the soil. Fallen leaves, humus or vegetable mould also act powerfully in absorbing rainfall, and add very considerably to the surplus amount of moisture retained in the soil.

6. *As regards the Feeding of Streams and the Protection of the Soil.*—From the above data it seems evident that the effect of extensive forests, more especially of those situated at high altitudes, is, by cooling the air and reducing its capacity for retaining aqueous vapour, to increase the precipitations. Whilst these precipitations are taking place the crowns of the leaves intercept a large proportion of the total, and by breaking the violence of the rainfall protect the soil from the danger of being washed away during heavy storms. When, therefore, large tracts of country are denuded of timber, increase of temperature during the days of summer, rapid radiation of soil-warmth by night, diminished precipitations (especially in the spring and summer), and unchecked evaporation of moisture, due to complete isolation of the soil by day and absence of any protection from winds, must be the inevitable consequence. Examples of such actual results can be pointed out in continental Europe, Western Asia, and in India. In localities having no protective woodlands, heavy rains wash away the surface soil, torrents and freshets rush down the water-courses with great violence laden with detritus, and often causing floods. Forests tend to break the violence of the rainfall and retain for a time a large portion of the precipitations.

7. *As regards General Hygienic Effect on the Atmosphere.*—It is well known that when large tracts of forest are cleared for cultivation, especially in tropical and sub-tropical countries, fever and ague are the consequence, and on the other hand that planting-up of notorious fever districts has decidedly diminished the insalubrity of such localities.

8. *As regards the Agricultural Productive Capacity of Neighbouring Tracts, and the National-economic Effect on the Soil generally.*—Forests may locally modify climatic conditions. Such modifications, if they exist, are of great practical value. Forests may also modify water conditions. Early in the present century it was reported that in consequence of the reckless destruction of forests in Southern France after 1789: "The winters are colder, the summers hotter, and the beneficial spring and autumn showers no longer fall. The chief river rushes down in flood with the least rain, carrying away its banks and flooding the rich pasturage, while, for nine months of the year, its bed lies dry owing to the drying up of the streams." To a similar cause also the Russian famine of 1892 was attributed by a writer in *The Speaker*. When the country is deprived of its trees, the earth is dried up and crumbles from the hills. The water that falls cannot be kept back, as is the case with the woods, which act as a sponge, but rushes in torrents along the river courses. A report on agriculture in South-east Russia is commented on as follows:—"It is said that this gigantic natural tillage farm (*i.e.*, the 'black-soil' region) was formerly edged in by belts of forest, which served the twofold purpose of sheltering it from the desert winds and of increasing the humidity of the climate. It is certain that these forests do not now exist, and that the black-soil

country is often scourged by devastating blasts from the Steppe, and not infrequently baked by prolonged droughts. In summer the winds are so fierce and arid that in the space of a few hours they wither the crops as they stand, while, when they are laden with sand, they smite the soil itself with perpetual barrenness."

In order to obtain the full national-economic benefits that are derivable from woodlands, the areas reserved as forests or planted-up should be scattered over the face of the country as equally as possible. It would at the same time seem to be worthy of consideration whether it would not be wise to expropriate tracts of the poorer and higher land here and there and plant them up on a well-considered scheme for the purpose of ameliorating the climatic conditions for man and beast in the future.

Potato Scab.

From what has been learned by various investigations up to date, in relation to the potato scab, it appears :—

1. That the scab is caused directly by the growth of a fungus upon the potato tuber.
2. That if the "seed" tubers and the soil are free from the germs the crop will remain free from the scab, if not contaminated by germs introduced in some manner, as in manures, upon implements of tillage, &c.
3. That the disease is liable to be spread by barn-yard manure, since scabby tubers or beets are not only handled about the barn, but are often fed uncooked to farm animals.
4. That smooth tubers may still bear the germs of the disease if they have come in contact with scabby ones, or have been put in bags, bins, &c., where scabby potatoes have previously been placed.
5. That the only way to insure a smooth crop is to avoid planting the potatoes on land which has been previously contaminated, to avoid the introduction of the germs in the manures and on implements used, and to treat the tubers before planting in such a way as to kill any germs already on them.
6. That if the germs are present in the soil, or are introduced on the tubers, the character of the soil and the nature of the manures (even if the latter are free from the germs) may, under certain conditions, exert a decided influence on the development of the scab.
7. That no practical method has yet been devised for destroying the germs of the disease in soils already infested with them.
8. That of all the methods of treatment of the seed-tubers and soil, none of them seem to give fully satisfactory results in case the soil is already badly contaminated with the germs.
9. That treatment of the seed-tubers with bichloride of mercury is a very effectual means of lessening the scab, if uncontaminated soil is employed, and if all other means of contamination are avoided.
10. That lime applied to the soil increases the scab ; but if tubers are treated, and soil is free from germs, lime can be applied without hesitation.
11. That if potatoes are scabby they should be dug early.

Notes on the above.—3. Cooking potatoes or beet before being fed to stock destroys any germs, and prevents contamination of manure from this source. 9. Two and one-fourth ounces of this substance (corrosive sublimate) should be dissolved in a few gallons of hot water, and enough cold water added to make 15 gallons of the solution. Use wooden vessels, and keep the liquid stirred. Seed potatoes may be put in a sack and dipped in the solution, which may be used repeatedly. It is a good plan to leave the tubers in the liquid an hour and a half, and they should be washed before being dipped. The material is excessively poisonous, so great care must be used.—Ex. Rhode Island, Ex. 8vo. reprint, Nov., 1893.

The Best Time to fell Timber Trees.

Mr. Forester Allan, of Milton, writes:—"The simplest and most reliable guide to find out the best time to fell timber trees, for public works and other purposes, so as to secure the greatest strength and durability derivable from its timber, is to fell the tree when the bark adheres firmly to the sap-wood. On the coast districts we have always been of the opinion that the winter months was the best time to fell trees, thinking that the sap would be dormant during that period, as in the case of trees of other countries, but I find from close observation that in many instances this opinion is wrong. The sap is flowing at the present time (July) in the spotted gum, woolybutt, redwood, stringybark, and in some of our ironbarks. The idea, therefore, that the winter months is the proper time to fell timber on the South Coast is a fallacy. I would, therefore, point out that the above test is the simplest and best, and in no instance have I known it to err."

Preventive against White Ants.

Mr. Forester Allan writes:—"Timber, if allowed to remain in sea-water for a few weeks, not only becomes seasoned, but the immersion proved to be a preventive against the ravages of the white ant. Captain Wilson, one of the oldest inhabitants of Shellharbour, informs me that he has proved successfully in his own case that immersing timber in sea-water for a time is a thorough preventive against the pest, and that it adds to the durability of the timber. This is a subject well worthy of further investigation."

[We believe that there is no absolute preventive against white ants other than poison. At the same time, it would be useful to inquire to what extent immersion in sea-water renders timber less liable to destruction by these pests. Of course wood rendered saline through immersion is diminished in value for most purposes.—Ed.]

Imitation Ironbark.

Mr. Forester Allan sends from Bateman's Bay two samples of timber cut by him from railway sleepers showing what is often sent to Sydney for ironbark. He remarks:—

"1 B.—From a tree locally known as woollybutt, and sometimes called redwood; botanical name, *Eucalyptus saligna.* A favourite timber for felloes and inside housework; no good for posts or underground work; is not at all durable.

"2 B.—From a tree locally known here as peppermint or redwood and woolybutt in the Bega district; botanical name, *Eucalyptus longifolia.* A splendid timber for posts or underground work; no good where strength or elasticity is required; very brittle."

Worth Noting.

Sand-flies.

Workers on the coast where sand-flies are plentiful are advised that immunity from attack is secured by rubbing the face and hands with olive or any other oil before commencing the day's operations.

Mosquitoes.

In India the people to scare away mosquitoes suspend a plant of *Aloe perfoliata.* The Chinese burn wormwood rolled up in the form of pastilles with some fragrant resin (we might try the resin from our scrub pines of the genus *Callitris*).

Pennyroyal plants suspended in a room are said to be equally effective against fleas, flies, and mosquitoes.

Sorghum vulgare.

The most peculiar of the diseases (?) to which it is liable is that which makes the young stalks poisonous to cattle (in India) if eaten by them when semi-parched from want of rain. Of the fact there can be no doubt; their bodies become inflated after a meal of the young plants, and death ensues shortly afterwards.

To preserve books from destructive insects.

Brush them over with a saturated solution of corrosive sublimate, made by constantly keeping a little of the poison at the bottom of a jar of alcohol, so that the maximum amount is absorbed.

A little may be poured into the crevices of the binding with advantage.

It is a *deadly poison*, and should be carefully locked up when not in use.

Duboisia Leaves.

In the *Gazette* for November last there is an illustrated article on *Duboisia myoporoides*, found in the coast districts. The Department is in a position to place an order for 1,000 lb. of these leaves, and correspondence is invited from persons willing to supply a quantity not exceeding 250 lb. of the same; samples to be sent to the Department in the first place. Great care should be taken in drying the leaves. The operation should take place in a covered and well ventilated room or shed. They must be protected from the sun's rays and also from rain. They should be as free from stalks as possible. Dried leaves of the quality approved by the Department will be paid for at the rate of 6d. per lb., and they should be packed in bags containing (say) 20 lb. each. If a carefully dried and good article be supplied it will doubtless lead to further orders in the near future. While attending to our staple products we must not cease to endeavour to develop the minor products, such as *Duboisia* leaves.

AGRICULTURAL SOCIETIES SHOWS, 1894.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindale	Jan. 9, 10.
Albion Park A. and H. Association	T. Armstrong	„ 17, 18.
Kiama A. and H. Association	J. Somerville	„ 25, 26.
Holt–Sutherland H. and I. Society	W. Douglas	„ 26.
Wollongong A. and H. Association	J. A. Beatson	„ 31, and Feb. 1.
Berry A. and H. Society	A. J. Colley	Feb. 6, 7, 8.
Gosford A. H. and I. Association	H. S. Bevrendge	„ 9, 10.
Luddenham A. and H. Association	K. Campbell	„ 13, 14.
Manning River (Taree) A. and H. Association	W. Plummer	„ 14, 15.
Lithgow A. and H. Society	M. Asher	„ 15, 16.
Shoalhaven (Nowra) A. and H. Association	R. Leeming	„ 15, 16.
Ulladulla (Milton) A. Association	C. A. Cork	„ 20, 21.
Marulan P. and H. Society	H. Morrice	„ 23.
Kangaroo Valley A. and H. Society	H. Joyce	„ 25, 26.
Candelo A. and H. Association	C. H. Brooks	„ 27, 28.
Tumut A. and P. Association	W. H. Bridle	„ 27, 28.
Tenterfield P., A., M., and H. Society	J. Harker	„ 27, 28, and Mar. 1
Port Macquarie A. and H. Society	J. Y. Butler	„ 28 and Mar. 1.
Lismore A. and H. Society	C. S. Connor	„ 28 and Mar. 1, 2.
Yass P. and A. Association	B. A. Nicholls	Mar. 1, 2.
Berrima District (Moss Vale) A., H., and I. Society	J. Yeo	„ 1, 2, 3.
Nepean District (Penrith) A., H., and I. Society	R. Benaud	„ 1, 2, 3.
Robertson Agricultural Society	R. J. Ferguson	„ 6, 7.
Uralla P. and A. Association	J. D. Leece	„ 6, 7.
Bega A. and P. Association	A. J. Wilson	„ 7, 8.
Inverell P. and A. Association	J. M'Ilveen	„ 8, 9.
Picton Agricultural Society	G. Bradbury	„ 8, 9.
Crookwell A. and P. Association	H. J. Peard	„ 8, 9.
Cobargo A. and P. Society	J. Graham	„ 13, 14.
Tumberumba P. and A. Society	W. Willans	„ 13, 14.
Glen Innes P., A., and M. Association	J. Denshire	„ 14, 15.
Goulburn Agricultural Society	J. J. Roberts	„ 15, 16.
Gulgong Agricultural Association	C. E. Hilton	„ 16, 17.
Armidale (Combined Show), A. and P. Association	W. H. Allingham	„ 20, 21, 22.
Taralga A. and P. Association	J. J. Walsh	„ 21, 22.
Royal Agricultural Society (Sydney)	F. Webster	„ 21 to 27.
Braidwood P. and A. Association	G. F. Taylor	„ 22, 23.
Castle Hill A. and H. Association	F. H. G. Rogers	„ 26, 27.
Orange A. and P. Association	J. S. Thomas	„ 28, 29.
Walcha P. and A. Association	H. Chapman	April 4, 5.
Lower Clarence (Maclean) Agricultural Society	J. S. Dunnet	„ 4, 5.
Camden A., H., and I. Society	W. R. Cowper	„ 4, 5.
Gundagai P. and A. Society	W. E. Kyle	„ 5, 6.
Blayney P. and A. Association	G. H. Woolly	„ 5, 6.
Gundaroo P., A., and H. Association	J. Affleck	„ 6.
Namoi (Narrabri) P., A., and H. Association	J. Riddle	„ 11, 12,

Society.	Secretary.	Date.
Bathurst A., H., and P. Association	W. G. Thompson..	April 11, 12, 13.
Clarence (Grafton) P. and A. Society	T. Page	,, 18, 19.
Wellington P. and A. Association	R. Porter	,, 18, 19.
Hunter River (West Maitland) A. and H. Association	W. C. Quinton ...	,, 18, 19, 20.
Dubbo P., A., and H. Association...	G. H. Taylor ...	,, 24, 25, 26.
Warialda P. and A. Association	W. B. Giddes ...	,, 25, 26.
Mudgee Agricultural Society	J. M. Cox ...	,, 26, 27.
Williams River (Dungog) A. and H. Society ...	....	May 2, 3.
Coonamble P. and A. Association...	F. R. Salt	,, 2, 3.
Macleay (Kempsey) A. and H. Association ...	H. R. Gray ...	,, 9, 10, 11.
Gwydir (Moree) P. and A. Association	J. G. Cohen ...	,, 9, 10.
Hawkesbury District (Richmond) A. Association	C. S. Guest ...	,, 10, 11, 12.
Walgett P., A., and H. Society	P. W. Kenny ...	,, 15, 16.
Upper Hunter (Muswellbrook) A. and H. Association	E. C. Brecht ...	,, 16, 17.
Upper Manning (Wingham) A. and H. Society...	P. Doust	,, 16, 17, 18.
Central Australia (Bourke) P. Association ...	J. P. Martin ...	,, 23, 24.
Cumnock P. and A. Association	W. Newmarch ...	,, 24.
Brewarrina P. and A. Association...	H. L. Cathie ...	June 5.
Warren P. Association	F. C. Thompson ...	,, 7, 8.
Cobar P. and A. Association	A. Roxburgh ...	,, 13, 14.
Nyngan P. and A. Association	E. H. Prince ...	,, 20, 21.
Urana P. and A. Society	H. A. Hill ...	July 17, 18.
Deniliquin P. and A. Society	H. J. Wooldridge	,, 19, 20.
Hornsby, Thornleigh, Pennant Hills, &c., H. Association	H. Epthorp ...	,, 23, 24.
Riverina (Jerilderie) P. and A. Society	J. Fulton	,, 24, 25.
Hay P. and A. Association...	F. W. Blanche ...	,, 26, 27.
Condobolin A. and P. Society	W. H. Garnsey ...	,, 31 and Aug. 1.
Narandera P. and A. Association	J. F. Willans ...	Aug. 1, 2.
Forbes P., A., and H. Association...	W. G. Dowling ...	,, 9, 10.
Corowa P., A., and H. Society	A. A. Piggin ...	,, 15.
Northern (Singleton) Agricultural Association ...	C. Poppenhagen ...	,, 15, 16.
Parkes P., A., and H. Association	H. S. Harwood ...	,, 15, 16.
Grenfell P. and A. Association	G. Cousins ...	,, 16, 17.
Horticultural Society of N. S. Wales	E. S. Sautelle ...	,, 22, 23.
Burrangong (Young) P. and A. Association ...	C. Wright ...	,, 23, 24.
Moama A. and P. Association	C. L. Blair ...	Sept. 4, 5.
Cowra P., A., and H. Association...	S. Wright... ...	,, 5, 6.
Murrumbidgee P. and A. Association (Wagga) ...	H. T. Davidson ...	,, 5, 6.
Queanbeyan P. and A. Society	E. C. Harris ...	,, 11, 12.
Burrowa P., A., and H. Association	J. F. Clifford ...	,, 13, 14.
Albury P. and A. Association	G. E. Mackay ...	,, 13, 14.
Burrowa P., A., and H. Association	J. F. Clifford ...	,, 13, 14.
Junee P. and A. Association	T. C. Humphrys..	,, 19, 20.
Upper Manning (Wingham) A. and H. Society...	Spring Show ...	Nov. 2.

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[1 plate.]

THE

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CONTENTS.

Useful Australian Plants.

BY J. H. MAIDEN,
Consulting Botanist.

No. 13.—THE BLACKBUTT.

(*Eucalyptus pilularis*, Sm.)

Other vernacular names.—The name Blackbutt is a very good one, and has been given on account of the blackish bark (the depth of colour being often largely the result of a bush fire), on the butt. Thirty or forty years ago the late Sir William Macarthur used to call it "Black-butt Gum."

Perhaps on account of confusion with other trees Sir William stated it to be the "Mountain Ash" of Illawarra, and the "Willow," or "White Top" of Berrima. But it may be mentioned that anything approaching precision in regard to the vernacular names of Eucalypts has only been possible within the last ten or fifteen years. Of course there is room for vast improvement yet, but up till quite a few years ago the situation was complicated through the deficient botanical knowledge of those who referred to these trees. It seems probable that *E. virgata* (*Sieberiana*) is the tree which Sir William Macarthur designated *pilularis* (probably on account of its rough bark and smooth branches).

"Flintwood" is an old name for Blackbutt. When chopping dry blackbutt sparks will often fly from the axe. This may, perhaps, have caused the former name to be employed. According to Baron von Mueller (*Catal. of Timbers, Technological Museum, Melbourne*), Gippsland Blackbutt or Flintwood is of a reddish colour. Our Blackbutt is, of course, pale-coloured, showing no tinge of red, and this difference in the timbers may point to some botanical difference.

Aboriginal names.—"Yarr-Warrah" of the Illawarra blacks, according to the late Sir William Macarthur. Another name of New South Wales aboriginals was "Benaroon." Those of South Queensland called it "Tcheergun," or "Toi."

Botanical name.—*Eucalyptus* (explained formerly). *Pilularis*, from the Latin *pilula*, a little ball, alluding to the shape of the fruits.

Flowers.—The flowers are white, and as far as my experience goes, the blackbutt usually flowers about every second year. Mr. Forester Rotton states that in his district the blackbutt blooms about November and December, and is much sought after by bees. In the Bulli district it is supposed to be about the best flower of any of the hardwoods for honey purposes, the honey being thick, and of nice colour and flavour.

Fruit.—The spherical or pilular shape of the fruit capsules is brought out in the drawing. Blackbutt fruits can hardly be confused with those of any other. Those of *E. eugenioides* (one of the stringy-barks) are often spherical, but they are a good deal smaller than those of *E. pilularis*.

Exudation.—From this tree a "gum" or kino exudes. It sometimes issues forth in large quantities through the fissures in the bark, and often (particularly in badly-grown trees), pockets of kino are found where the timber "shells," and, normally, rings of kino more or less wide are found in the timber. This kino is of a ruby colour, quite transparent, and, while fresh, readily and entirely soluble in water or spirit. It is a member of the "Ruby group," one of the three groups into which I have divided the kinos of the Eucalypts. It is a perfect substitute for the kino of the Pharmacopœia. A rather old sample analysed by me some years ago was soluble in water to the extent of 96·4 per cent. (kinos become less readily soluble by age); it contained 65·52 per cent. of kino-tannic acid, and 2·8 per cent. of insoluble phlobaphenes.

The circumstance that kino is usually present in blackbutt wood is readily illustrated by the intense black imparted to a plank which comes into contact with water impregnated with iron, or the readiness with which a black stain is made in blackbutt wood when a nail is driven into it.

Bark.—The Blackbutt belongs to the "half-barked" (*Hemiphloiæ*) group of Eucalypts—that is to say, it has fibrous bark on the butt, while the branches are smooth like those of a gum. The fibrous bark is brownish, which often turns blackish through the agency of bush fires, and frequently the barks of the trees weather to a whitish appearance. Mr. Forester Rotton states that blackbutt bark is sometimes used for roofing pig-styes and calf pens, but does not last long when exposed, yet if kept dry and under cover it is very useful for flooring hay-lofts, &c., becoming quite hard, and lasting a long time. It is, however, far less fibrous than, and altogether inferior to stringybark.

Leaves.—Their shape is brought out in the drawing. They are rather coriaceous, and contain very little eucalyptus oil, but the percentage of essential oil in the leaves, or its characters have not, so far as I am aware, ever been ascertained.

Timber.—Blackbutt is pale-coloured, and furnishes excellent timber for house carpentry or any purpose where strength (it is one of the strongest timbers we have) and durability* are required, *e.g.*, bridge planking, ships' decks, paving cubes, &c. It and tallow-wood are the two timbers most approved for paving in Sydney. It is extensively used for fencing purposes. It is also used for telegraph-poles, and also, to some extent, for railway-sleepers. As evidence of its good quality, I have it on good authority that a quantity of blackbutt sleepers were used on the Goulburn-Bungendore extension, with the approval of the engineer. It is close-grained and may be used for wheelwrights' work. It is but an indifferent fuel unless thoroughly dry. Its liability to gum veins has prejudiced it in public favour; in fact, the presence of these defects is a valuable diagnostic character of this wood. When free or comparatively free from these veins the timber is undoubtedly of high class, and in view of its hardness, durability, and strength, it is by many people considered to be only second in value to ironbark. It is a tractable, good, all-round timber. Even in the very early days of the Colony this wood was appreciated, being esteemed for house carpentry or other purposes when strength and durability are objects. It occasionally, though rarely, shows pin-holes. As regards white ants, these pests are undoubtedly fond of blackbutt. Many trees which are

* **For a note as to its durability see *Gazette* for September, 1893, p. 681.**

hollow are infested with white ants, but these insects probably do not commence the mischief, but attack the debilitated tree whose heart has begun to decay as the result of fungus-growths, the ants enlarging the "pipe" thus created. In the Bateman's Bay and Moruya district, when it occurs plentifully, it is said that although the white ants are found in the heart of the living tree they never attack the timber when it is dry.

Following are a number of brief reports on the timber, arranged geographically, from south to north, with the view of showing the varying estimation in which it is held in different districts:—

Blackbutt splits well and is much used for fencing; it is also excellent timber for decking wharfs and bridges, house building, or for any purpose where a good durable timber is required. On one occasion I noticed gum veins running through boards cut from this timber, and was informed by timber-getters that these veins seldom extended past that portion of the tree covered by rough bark, and were always confined to old trees.—(Forester Benson, Bega).

Mr. Forester Rotton, of Picton, remarks that it is very durable and strong, is used for building purposes, and has given great satisfaction for bridges, culverts, and fencing; in fact, most of the fencing and some of the culverts on the Illawarra railway line, between Clifton and Kiama, consist of blackbutt timber, and it is very much sought after for cottage-building in the same locality. It will split into posts, rails, and even palings very easily, and his opinion is that if properly seasoned it is one of the best hardwood timbers we have.

Mr. Forester Martin, of Gosford, reports that the blackbutt is one of the best of our hardwoods for strength and durability. It stands exposure, does not rot in the ground, and is used for piles, planks, posts and rails, palings, slabs, laths, battens, and flooring boards; in fact, it is a good all-round timber, and, when dry, not a bad fuel. When building bridges on the railway line that runs through Mr. Martin's district, it was found that turpentine piles would split when driven in hard ground, and blackbutt ones were used instead and drove well.

Mr. Forester Rudder, of Booral, speaks of the timber as hard, close-grained, and durable, either in or out of the ground, straight in the grain and fissile. It is excellent for split slabs, fence rails, palings, shingles, for sawn battens, flooring boards, scantling, &c. In seasoning it shrinks a good deal, but warps very little. The best quality of timber is usually found on dry, open ridges.

Mr. Forester G. R. Brown, of Port Macquarie, remarks that blackbutt is a most useful timber for all building purposes—flooring, joists, &c.—also for the decking of bridges (for which it is not so valuable as tallow wood). Posts for fencing last about twenty years, and rails about thirty years.

Mr. Forester Pope, of Murwillumbah, states that all the hardwoods of his district are more or less faulty, and the blackbutt is not an exception. It is often veiny (gum veins), but the timber, as a whole, may be considered as being a very fair one. He thinks that after ironbark, grey gum, and tallow-wood, it is as good as any of the timbers here, though he is told it is not as good as the southern blackbutt. This may be because of the humidity of this climate. The Railway engineers will not take it. At least, it was condemned on the Lismore-Tweed railway both in sleepers and fencing. To condemn it for fence material is not doing the timber justice, he thinks. He knows of a fence, in which the posts were blackbutt, which is quite sound yet, and it

has been in the ground nearly fifteen years. Of course, whether a timber will last or not depends to a great extent on the season in which the timber is cut. There are a number of charcoal burners in the district who all say that blackbutt is the best timber by far for making charcoal. It does not "fly" as many of the other kinds do. White ants will attack blackbutt, but it is not more subject to their ravages than many others.

Going inland the blackbutt trees diminish in size, and the quality of the timber deteriorates. There is a good deal of it in the Armidale district, but Mr. Forester Siddins says that it is not considered of special value. It is very spongy, *i.e.*, full of sap, and will not stand contact with the ground. This fault might be remedied if the timber were well seasoned before being used. As a rule it is sneaked in with other timber as studding, for which purpose it seems to answer fairly well. Owing to its warping and shrinking it is of no value for flooring or weather-boards in the district.

However, Mr. Imberger, of Tenterfield sawmill, who has been working timber for the last thirty years in that district, informs Mr. Forester Deverell that blackbutt is really good for building purposes, such as weather-boards, flooring and scantling, and also for decking. He also asserts that he has seen it used for fencing posts, but it only lasted for twenty years.

Mr. Forester Marriott says of blackbutt that in Mudgee and the neighbouring towns it is seldom used, other and more plentiful timber taking its place. Timber-getters who have worked blackbutt describe it to him as very durable in the ground, easily worked, being free in the grain, therefore splitting evenly, and as specially suitable for posts, foundation blocks for wooden buildings, palings, lathes, and has occasionally being used for beds of waggons and other wheelwright's work.

I have made some remarks on the variation in quality of blackbutt timber in different districts under the head of "Distribution."

Size.—The average height of mature blackbutt is from 100 to 150 feet, with a diameter of 3 to 5 feet.

I believe the blackbutt to have attained the biggest bulk of any tree in New South Wales, and I trust that correspondents of the Department will furnish particulars of all New South Wales trees of exceptional size.

Following are the particulars of the celebrated "Bulli Big Tree," which is found part of the way up the Bulli Mountain, near the coast, 42 miles south of Sydney. The measurements were taken by myself in March, 1891, with a steel tape. The girth of the Bulli blackbutt at the ground, measuring from buttress to buttress is 57 feet 6 inches. The girth at 3 feet above the ground is 45 feet, and at 6 feet above the ground 40 feet. The taper is then very gradual for about 90 feet (estimated), where the head is broken off, but it has a vigorously growing leafy top, and some of its branches are of the size of small trees. I estimated that the first branch springs from the trunk at a height of 50 feet. There are ten principal buttresses, of an average diameter of over 2 feet, but they practically cease to flute the trunk at a height of 10 to 15 feet.

This gives 15 feet diameter at a height of 3 feet from the ground, but there are some charred stumps in the vicinity of even greater diameter.

In the year 1854 the late Sir William Macarthur "lately measured a specimen at Bullai, Illawarra, still in full vigour, and with no external symptoms of decay, 41 feet in circumference, with the bole of immense height."

This may be the tree I measured in 1891, but the latter has, since 1854, been struck by lightning, and it is hollow at the butt, having been burnt by careless picnickers who came to view it.

Many of the blackbutt trees in the Bega forest district reach an altitude of 200 feet, with a diameter of 7 and 8 feet. Some of the trees have a barrel of about 70 feet without a limb (Forester Benson).

In Mr. Forester Rotton's district (Illawarra and the high land to the west of it) the blackbutts attain great dimensions, *e.g.*, the Bulli Big Tree already referred to. This is, of course, of quite exceptional size, but the blackbutts usually have long barrels in that district, and many of them are 100 feet up to the first fork.

In the Gosford district Mr. Forester Martin estimates the size of blackbutts up to 180 feet, with a diameter of 2 to 4 feet. Large trees are usually hollow. A dead limb on a blackbutt of any age generally denotes unsoundness. The blackbutt is a quick grower, and will mature in about twenty-five years.

There is a blackbutt at Gosford 156 feet high, and nearly 8 feet in diameter at a height of 6 feet. I give these as specific measurements, but there are many blackbutts in the Colony far larger than this.

Mr. Forester Rudder, of Booral, estimates the height of blackbutts in his district at from 150 to 170 feet, "with a diameter exceptionally of from 5 to 6 feet, rarely up to 7 or 8 feet, and very exceptionally, when burnt or hollow below, to 9 or 10 feet."

Mr. Forester Brown, of Port Macquarie, states that in his district blackbutt grows up to 200 feet high, with a diameter of 9 feet, and that on fairly good, deep red or chocolate soil it takes about forty years to mature (say, 50 feet to first limb, and 2½ feet diameter at butt). Mr. J. Laurie states that a blackbutt grew in twenty-one years large enough for the mast of the "Maggie Gollan," viz., 65 feet long, and 14 inches square. (*Agricultural Gazette*, September, 1893, p. 681.)

Average height, 100 to 150 feet, and maximum diameter of 2 feet 6 inches, 6 feet from the ground, in the Richmond River District. (Forester Pope.)

As evidence of the small extent to which some of our trees alter externally during lengthened periods, the late Rev. Dr. Woolls (writing about 1860) stated that the blackbutt on which Lieut. Lawson cut his initials in 1813, still presented the letters as legibly as ever. This interesting tree, so intimately connected with the first expedition over the Blue Mountains, is standing on the side of the Bathurst Road, on the summit of Pulpit-hill, overlooking the Kanimbla Valley.

Distribution.—Found more or less along our sea-board, usually found near the coast, but more rarely extending inland to mountain slopes. It extends from Eastern Gippsland, in Victoria, along the whole of the New South Wales coast districts, and to Southern Queensland. Blackbutt would appear to attain its greatest perfection about midway between Sydney and the Queensland boundary. Magnificent forests of blackbutt occur on the south coast (*e.g.*, about Termeil I noticed very giants in stature and girth, furnishing free, straight timber, which split into palings with almost the facility of stringybark); then, as the Sydney district is approached, the quality of the timber diminishes (though there was some grand blackbutt about Sydney in the early days). Proceeding north the blackbutt appears

to attain its greatest perfection, say, in the Cape Hawke District, and then' as the far north of the Colony is approached, its quality becomes the most inferior of any in the coast districts. In a word, the best northern blackbutt is better than southern blackbutt, but the best southern blackbutt is, nevertheless, timber of high quality.

Mr. Forester Benson, of Bega, says that blackbutt is but little used in his district owing to the belts of timber which occur being too far removed from the saw-mills and shipping ports. It grows in abundance in the parishes of Wallagoot, Wapengo, and Wagonga, counties of Auckland and Dampier. In a large area of country lying between Wapengo and Wagonga there is no blackbutt, and this appears to be remarkable, as apparently the same formation and the same natural conditions exist as in places where it is abundant. North of Wagonga, and more especially between Moruya and Ulladulla, there are large quantities of blackbutt. It is plentiful in the gullies at the back of the Bulli Mountain and Mounts Keira and Kembla. It prefers good soil. It is fairly plentiful in the Gosford district, but it is not found growing all over it. It likes broken country of sandstone formation, and, according to Mr. Forester Martin, it thrives best in gullies and on the slopes of ranges in not very good soil.

Referring to the counties of Durham and Gloucester more particularly, Mr. Forester Rudder points out that when close to the influence of the sea breezes, and on sandy land, trees are usually stunted. A little inland the growth is quick and upright, with long, straight boles, some of the trees attaining to a height of 80 or 100 feet in about thirty years, with a diameter of 2 feet.

Mr. Forester G. R. Brown, of Port Macquarie, remarks that the best quality of blackbutt grows on high ridges, a breezy position, and with good drainage, with good depth of soil; in such a position carrying the girth at butt for 8 to 12 feet up, and decreasing very little to the first limb. It is the most abundant timber in this district, from McLeary River to the Wollamba, about 90 miles by 25, averaging about four trees to the acre.

Mr. Forester Pope's district (Tweed), blackbutt is stated to be generally indicative of poor soil.

Mr. Forester Pope states that blackbutt is well distributed throughout the whole of the Richmond and Tweed districts (county Rous), and he estimates that it would be found on one-half of the whole area of "hardwood" or forest country at an average of five trees to the acre.

Mr. E. J. Deverell, forester, of Glen Innes, states that blackbutt is not plentiful in his district, and even then is only found on the eastern falls.

Mr. Forester Siddins, of Armidale, remarks that it is found in large quantities in his district, but it is of a very inferior quality.

Coming south to the Mudgee district, Mr. Forester Marriott says that, within the area inspected by him, blackbutt is limited entirely to two reserves, viz., No. 77, parish of Jesse, county of Roxburgh; but though there are some fine trees, its growth is, generally speaking, far less luxuriant than in the coast district.

Following is an official statement from the Forest Department showing the distribution of blackbutt in the various forest reserves throughout the Colony.

Blackbutt.

No. of F.R.	County.	Area in acres.	Class.	Size of trees.	How distributed. Number of trees.	How distributed. Over area.	Royalty per 100 sup. ft.	Quality.	Remarks.
				feet girth		acres.	pence.		
1	Auckland ...	720	A	6	2 over	720	...	Good.	
2,341	Buccleuch ...	22,970	B	4	7 ,,	22,970	...	,,	
1,120	Butler, Rous, and Drake.	80,788	A	4	......	80,788	...	,,	
175	Camden	1,600	C	6	10 over	175	6	Fair.	
24	Clarence	2,500	A	6	2 ,,	800	...	,,	
26	,, ...	1,040	A	8	1 ,,	800	...	Good.	
242	,, ...	11,100	C	6	5 ,,	5,000	6	,,	
243	,, ...	7,600	C	6	8 ,,	3,000	6	,,	
353	,, ...	4,480	C	6	6 ,,	2,200	6	Fair.	
2,123	,, ...	9,250	C	6	8 ,,	3,000	6	Good.	
1,101	Richmond and Clarence.	19,016	A	6	7 ,,	12 %	...	,,	
1,663	Clarke	16,933	C	7	6 ,,	960	12	V. good.	
33	Cook	158	C	6	3 ,,	100	...	Good ...	Exempt.
110	Cumberland ...	5,408	C	5	12 ,,	2,000	8	V. good.	
16	Dampier	4,180	C	7	2 ,,	1,000	3	Good.	
307	,, ...	7,835	C	7	4 ,,	3,000	6	V. good.	
9,248	,, ...	2,800	A	7	3 ,,	1,000	...	Fair.	
913	Drake	500	A	9	2 ,,	400	...	Good.	
112	Dudley	2,453	A	7	2 ,,	1,000	...	,,	
158	,, ...	79,680	C	11	2 ,,	640	...	,,	
3,753	,, ...	16,000	C	10	1 ,,	4,000	...	,,	
12,301	,, ...	6,500	A	...	......	......	...	,,	
14,537	Dudley and Raleigh.	47,205	C	10	3 over	2,000	...	,,	
195	Durham	1,250	A	7	6 ,,	1,250	...	,,	
136	Fitzroy	12,440	A	8	1 ,,	6,000	...	,,	
354	,, ...	48,000	C	6	1 ,,	40,000	6	,,	
642	,, ...	30,043	C	7	1 ,,	5,000	3	,,	
2,439	,, ...	4,680	A	6	1 ,,	3,500	...	,,	
10,786	,, ...	18,560	A	7	2 ,,	2,000	...	,,	
121	Fitzroy and Raleigh.	15,904	A	8	1 ,,	10,000	...	,,	
46a	Gloucester ...	26,700	A	10	3 ,,	9,000	...	,,	
58	Hunter	6,120	A	5	5 ,,	2,000	...	,,	
33	Macquarie ...	2,100	C	7	6 ,,	2,100	3	,,	
34	,, ...	10,000	A	10	4 ,,	7,500	...	,,	
100	,, ...	7,472	A	8	4 ,,	3,500	...	,,	
144	,, ...	12,262	A	10	5 ,,	12,262	...	,,	
235	,, ...	3,840	C	8	6 ,,	2,000	3	,,	
13,877	,, ...	3,600	C	9	3 ,,	3,600	3	,,	
46	Northumberland	15,954	C	10	3 ,,	15,954	12	,,	
69a	,, ...	6,394	C	7	2 ,,	1,760	...	,,	
70	,, ...	33,186	C	6	6 ,,	10,000	12	,,	
128	,, ...	1,280	C	6	6 ,,	1,000	12	,,	
216	,, ...	9,700	C	6	3 ,,	2,000	6	Fair.	
14,972	,, ...	6,150	C	6	2 ,,	2,000	6	,,	
111	Raleigh	3,590	A	9	1 ,,	2,000	...	Good.	
4,780	,, ...	2,500	A	8	1 ,,	2,280	...	,,	
13,736	,, ...	4,000	A	8	4 ,,	3,000	...	,,	
9	Richmond ...	2,300	A	6	2 ,,	1,800	...	,,	
12	,, ...	4,800	A	7	2 ,,	2,800	...	,,	
13	,, ...	2,800	A	7	1 ,,	2,000	...	,,	
14	,, ...	1,500	A	7	2 ,,	1,250	...	,,	

BLACKBUTT—*continued.*

No. of F.R.	County.	Area in acres.	Class.	Size of trees.	How distributed. Number of trees.	How distributed. Over area.	Royalty per 100 sup. ft.	Quality.	Remarks.
				feet girth		acres.	pence.		
625	Richmond ...	3,900	C	6	2 over	3,000	6	Good.	
894	,, ...	6,400	A	7	2 ,,	5,000	...	,,	
973	,, ...	1,200	A	7	2 ,,	1,000	...	,,	
10,571	,, ...	5,900	A	7	1 ,,	5,900	...	,,	
249	Rous	16,661	C	8	4 ,,	4,000	...	Medium.	
258	,, ...	1,280	C	7	2 ,,	1,100	6	Good.	
77	Roxburgh ...	5,120	...	...	......	......	...	Fair.	
33	St. Vincent ..	4,480	C	6	2 over	500	6	Good.	
99	,, ...	6,058	C	6	4 ,,	3,000	2½	,,	
129	,, ...	500	A	8	3 ,,	300	...	Fair.	
6,215	,, ...	5,300	A	7	4 ,,	2,000	...	Good.	
10,616	,, ...	49,250	C	8	3 ,,	20,000	3	,,	
10,617	,, ...	54,693	C	7	4 ,,	24,000	3	,,	
23	Westmoreland ...	11,520	A	7	4 ,,	11,000	...	,,	
83	,, ...	1,520	A	7	4 ,,	1,000	...	,,	
90	,, ...	7,000	B	2	8 ,,	4,000	...	Fair.	
100	,, ...	2,284	A	7	6 ,,	1,500	...	,,	
384	Wellesley ...	570	A	...	......	......	...	,,	
828a	,, ...	750	A	...	......	750	...	Good.	

Propagation.—The blackbutt reproduces itself more freely than do the generality of our hardwoods. Where one old tree has been felled thousands of saplings will spring up. In most cases there is no necessity to artificially plant blackbutt. What is required is to conserve and thin out the exuberant crop of this valuable tree, planted by bountiful nature. I repeat that blackbutt is one of the most valuable of our hardwoods, and it is worthy of every consideration in any scheme of forestry.

Reference to Plate.—A, leaf, showing venation; B, flower-buds; C and D, clusters of fruits, natural size, and reduced.

The sketch is from a blackbutt tree near the Wesleyan Church at Homebush, near Sydney, whose diameter is 4 feet 3 feet from the ground, and whose height (estimated) is 130 feet.

(11 b 144-94.)

Eucalyptus pilularis, Sm.

"The Blackbutt."

A Suspected Poison Plant.

The Wild Parsnip (*Trachymene australis*, Benth.)

By J. H. MAIDEN,
Consulting Botanist.

Botanical Name.—*Trachymene*, Greek *trachus*, rough, and *mene*, a crescent (alluding to the fruitlet); the fruits have roughened surfaces; *australis*, southern.

Synonym.—*Didiscus*, *Di*, adaptation of Greek word for two; *diskos* (Latin, *discus*), disc, alluding to the fruitlets; *pilosus*, Latin, hairy, alluding to the frequent hairiness of the plant.

Some few months ago a plant was sent to the Department from the western part of the Colony, with the statement that it was poisoning stock. The following extracts from letters written at the time to the Department are self-explanatory.

Mr. C. J. Conway, of Mungunyah, Warrego River, writes:—"I have been living in this district for the last seventeen years, and I have only noticed this plant two years since, and that was after heavy rain, the country where it grew being red burnt country. During the good seasons of 1890 and 1891 the grass grew very thick and high in the red Mulga country, and in November, 1891, a large bush fire took place, and clean burnt out two homestead leases (Harvey's and Hind's), destroying a lot of scrub. Heavy rain fell the following winter, and this plant made its appearance, only thinly at first, but now it grows very dense all over this burnt country, just as thick as a lucerne field, and those leases have been utterly useless for the last two years. Nothing else seems to grow but this rubbish, and as there are miles and miles of it, it is impossible to get rid of it by pulling it up and burning it, as this would cost an immense sum of money. This district is simply full of it. I notice it is more severe on stock after rain, when it is very green. Stock do not care for it if they can get anything else. Now, in the middle of summer this wretched plant is quite green when everything else is parched up. We have lost a lot of both cattle and sheep through this plant, and cannot use the country. Our only hope is that it will die out, as it is now so thick, or if it becomes dry we may be able to burn a lot of it. The rabbits are numerous and run all through it, eating up every other kind of plant but this. The rabbits do not touch it, but prefer to eat the bark of scrub, or anything else. It has a stupefying effect on sheep, and you can scarcely drive or get them along. They die very quickly if not taken very carefully and steadily. Cattle go mad with it, running about switching their tails. They scour and get very poor if left where it grows, and finally die. Neither sheep nor cattle will touch it if they can get anything else, but if hungry cattle come on a patch of it they are bound to die." Again, Mr.

Conway:—"It grows thick and high on the burnt red country, but does not grow on black soil. About 100 head of travelling cattle (Hammond's) were poisoned about the middle of November, on travelling stock route near Enngonia, and adjoining Harvey's and Hind's homestead leases."

Messrs. Harvey and Hinds write:—"Both our homestead leases are densely covered with a plant which is known here as the whiskey plant, on account of it making all kinds of stock using it quite stupid, and finally killing them."

The plant was determined to be *Trachymene australis*, Benth. By some it is called the "wild parsnip."

In December, 1887, this same plant was reported by Baron von Mueller as having caused the sudden death of numbers of cattle in the vicinity of Dandenong, Victoria, and it was stated that its action was so powerful, that no remedial measures seemed of any avail.

In the case of the Mungunyah cattle, I was at first inclined to the opinion that they had been poisoned by the wild parsnip, but although the plant has such an extended range, no reports of its poisonous nature reached the Department from any other place, and it was also brought to notice that cattle had died at Enngonia (on a property adjacent to Mungunyah) of a disease which was determined to be anthrax. I then submitted that it was not at all improbable that the Mungunyah cattle may have died of anthrax. The symptoms noticed in them after they had eaten the wild parsnip might be accounted for by acute indigestion, which would supervene after the greedy feeding of succulent greenstuff by hungry animals.

Mr. E. Stanley, the Government Veterinary Surgeon, from the evidence before him, pronounced the Mungunyah cattle to have died of anthrax, and the Minister authorised experiments to be made by feeding cattle exclusively on wild parsnip for a period. It was found impossible to complete these experiments last season, but the balance of evidence seems to be against the wild parsnip being a poison in the strict sense of the word. Nevertheless, anthrax or no anthrax, there is no doubt that it may be fatal to hungry animals eating inordinately of it, and even clover and lucerne have caused fatal effects in herbiferous animals, yet no one would style them poison-plants.

I trust that, now public attention has been drawn to the wild parsnip, graziers will keep it under observation during the next few months, and report upon it to the Department. Owing to its wide distribution, it must very frequently be eaten more or less by stock, admixed with other herbage.

Other suspected Umbellifers.—Besides the wild parsnip, the only Australian umbelliferous plant I have heard of as reputed to be injurious (but not actually poisonous) to stock is a little plant known as wild parsley (*Apium leptophyllum*, F. v. M.). It is said that this plant is sometimes acrid, and therefore disturbs the digestion of stock, but I have heard no specific charges against it. I would point out that umbelliferous plants found growing near water or marshy ground are often acrid, and even poisonous, while those growing on dry ground are usually little more than carminative. Bearing in mind the uncertainty of the evidence in the case of the wild parsnip, it may be of interest to have the following notes in regard to the effects of certain allied plants in England. These observations may be relied upon as having been proved through a long series of years. I would, however, again remind my readers that absolute acridity or poisonousness in a plant is a different thing to the tendency to cause stock to be "blown," or to suffer from some form of indigestion, although, as far as the grazier is concerned, the ultimate effect may be the same, *i.e.*, to destroy his cattle.

Trachymene australis, Benth.

"Wild Parsnip."

Sium latifolium, Linn., "Great Water Parsnip."—This plant is of an acrid and poisonous nature, particularly the roots; they are noxious to cattle, making them quarrelsome and pugnacious. Horses and swine eat it. Sheep are not fond of it.

Cicuta virosa, Linn., "Water Hemlock."—This plant is also known as cowbane, and is one of the most virulent of our vegetable poisons. Cattle are not infrequently destroyed by eating it.

Conium maculatum, Linn., "Common Hemlock."—This plant is well known, and its injuriousness to stock has passed into a proverb.

Œnanthe crocata, Linn., "Hemlock Water-Dropwort."—One of the most dangerous of English plants, dangerous alike to human beings and to stock.

Œ. phellandrium, Lam., "Fine-leaved Water-Dropwort."—Linnæus informs us that horses in Sweden are seized with a kind of palsy on eating this plant.

Some of these plants are specific poisons, and their poisonous nature is recognised by some of the most eminent scientific authorities of Europe.

Eradication of Weeds.—When an objectionable plant takes possession of a tract of country the method of getting rid of the pest becomes a matter of practical importance. A succulent plant, like the wild parsnip, cannot be burnt off while in that state. The plant can be pulled up by the roots before it seeds, but this is only practically possible if it be taken in time, *i.e.*, before it has taken possession of a large tract of country. The only comfort one has is that, sooner or later, a weed which threatens to overwhelm everything dies down almost as suddenly as it has appeared, probably (but this is surmise) through it having ceased to obtain from the soil the nutriment it requires to ensure healty existence.

Distribution.—Found in all the colonies, and pretty well distributed from the coast to the interior.

Reference to Plate.—Wild Parsnip: The root-stock and flowering portion collected in different localities, and at different dates. A, floret; B, involucral bracts; C, fruit.

Additional Notes on Native Plants from the Port Macquarie District.

By G. R. BROWN,
Forester.

[THESE notes are a continuation of those by the same Forester as given on page 680, *Gazette* of September last. The Forester has recently sent a fine collection of local indigenous plants to the Department, including those in regard to which notes are given.]

Wild Arrow-root (*Cymbidium suave*, R. Br.).
Eaten by the blacks, who call it "Yarkrow." Shepherds in Queensland use it in dysentery.

Tow-wuk (*Dioscarea transversa*, R. Br.) is a small yam.

Mook-keet is a larger yam, about the size of a small pumpkin. (Herbarium specimens not sent.)
They are both cooked in ashes, and eaten like potatoes.

Wild Bamboo (*Flagellari indica*, Linn.)
Used by the blacks to make hand-nets for catching fish at the mouths of creeks, and called "Woorroogaroo."

Yatkeen, aboriginal name of *Xerotes longifolia*, R. Br.
Leaves used locally for tying up grape-vines.

Following are the aboriginal names (Manning River) for three plants:—

Mungummie (*Gymnostachys anceps*, R. Br.)
The well-known "settlers' twine."

Kit-tchin-barng (*Duboisia myoporoides*, R. Br.) "Corkwood."

Koongalbarng (*Eupomatia laurina*, R. Br.)
Known locally as "Wild Guava."

Warrimbarng was the name for "Grey Gum" (*Eucalyptus saligna*, Sm.) of the Hastings River blacks.

The following plants appear not to have been previously recorded from as far south as Port Macquarie:—

Cuttsia viburnea, F. v. M. (*Saxifrageæ*), locally known as "Elderberry."
Cadellia monostylis Benth. (*Simarubeæ*.)
Ratonia (*Cupania*) *pyriformis*, Benth. (*Sapindaceæ*.)
Acacia melanoxylon, R. Br., is locally known as "Broad-leaf Sally."
Loranthus pendulus, Sieb., var. *parviflorus*, Benth., is a mistletoe reported by the Forester to be locally found only on the prickly-leaved tea-tree (*Melaleuca styphelioides*, Sm.)
Persoonia vigata, R. Br., is sent by the Forester from Port Macquarie, which is an interesting locality for it, since so few are recorded.

Ramie—Its Production and Uses.

The plant known colloquially as Ramie, Rhea, or China Grass, and botanically as *Bœhmeria nivea*, Hook. et Arn., is probably one of the most valuable of the fibre-producing plants. It belongs to the nettle family (*Urticaceæ*), and grows to a height of from 4 to 8 feet. The leaves are alternate, toothed, three-nerved, broadly ovate, rough above, snow-white on the underside in one variety, greenish in another. The flowers are very small in clusters along a branched stalk, and both male and female flowers occur on the same plant.

Of the two varieties, Ramie is the name of that native in the Malay Archipelago, which is greenish on both sides of the leaf. It has been cultivated in Assam for many years, and is there known as Rhea. This variety is distinguished by the name *tenacissima*. The variety with the whitish underside to the leaves is a native of China, and has been conveniently designated at Chinese White Nettle. The fibre prepared from it, and imported into England, is known under the inappropriate name of China Grass.

China grass fibre generally obtains double the price in London of Rhea. Some writers state that the variety *tenacissima* produces the strongest fibre.

Cultivation.

From a bulletin* issued by the Botanical Department of Jamaica, where this plant is successfully cultivated, the following facts are taken :—

Climate.—The Malayan Ramie is essentially a native of an equatorial insular climate, with an equable temperature all the year round, and abundance of moisture. It has not succeeded well in India, except in the south, where a company is growing it, because in summer it is subjected to long-continued droughts and in winter to cold weather. In Jamaica there are no great extremes of temperature, and, therefore, wherever there is a sufficiency of fresh water for the roots, Ramie will flourish. Even in localities where the annual rainfall does not exceed 50 inches, it would probably succeed with irrigation.

"The Chinese White Nettle is a continental plant, and apparently more accommodating as regards moisture and drought than the Malayan variety. It has grown luxuriantly in Jamaica from sea-level up to perhaps 3,000 feet, and there is no reason to suppose that there would be any difficulty in cultivating it at the highest elevations. In Europe it succeeds best in the more northern areas, and the Malayan varieties in the southern. In America it is said that the Chinese variety is the more successful."

* Bulletin of the Botanical Department of Jamaica, vol. I, parts 3 and 4.

From the foregoing it would appear that the Chinese variety, which realises the highest price, could be successfully cultivated in New South Wales, with the natural conditions and rainfall on the northern rivers, and by means of irrigation in the warm western districts.

"*Soil.*—It grows best in a rich sandy loam, which is 12 to 15 inches deep, with a free subsoil. It is important to have perfect drainage, for the plant is intolerant of stagnant water.

"*Preparation of ground.*—The more thoroughly the ground is tilled before planting the quicker will the roots penetrate the soil, and the more satisfactory will be the result.

"*Propagation and planting.*—Ramie is propagated with some difficulty from seed, but easily by cuttings from the stem, and very readily and quickly by division of the roots. The difficulties in the way of obtaining a yield of seed, and afterwards in growing the seedlings, as compared with the ease with which the cuttings strike, make it unnecessary to discuss propagation by seed.

"To propagate by stem cuttings, let the stem become ripe, indicated by its turning brown; cut it into pieces, each containing three eyes or buds, close below the lowest eye, and close above the topmost; then plant so that the middle eye is just above the surface. It is not advisable to put these cuttings out at once into the open field, as they require a moist soil and shading from the sun for ten days. It will be found better to grow them for some time in a nursery until they have well-developed roots, then plant them out, at distances of 1½ to 2 feet apart, in straight rows.

"To propagate by division of the roots is the best plan. It is better done in showery weather. The roots should be cut so that there are five or six eyes to each portion. Plant out in straight rows at distances of 1½ to 2 feet apart. Some have recommended 4 feet as a proper distance, but this plan necessitates extra expense in weeding, and, besides, the fibre will be of better quality with close planting, which prevents branching. At distances of 1½ feet there is room for hoeing the weeds until the plants are strong. If the ground is shaded, as some recommend, then it is not so important to plant close.

"After some time every alternate row may be taken up altogether and transplanted in new ground, so as to extend the plantation."

A Chinese Treatise on Agriculture says of this plant:—"When the tufts are strong enough, the earth round is dug and new stocks are detached and transplanted elsewhere. The principal stock then grows more vigorously. At the end of four or five years, the old stocks becoming excessively strong, they are divided and replanted in other beds."

To put in roots at 1½ feet apart requires nearly 20,000 roots per acre. At 2 feet apart there are 10,890 plants to the acre.

Manure.—It has been ascertained that if the weight of dry stems obtained from one crop be only 1,000 lb. per acre, this gives, with three crops in the year, a yield of about 3,000 lb. of dry stems per acre per annum. The ash in that quantity will amount, according to a chemical analysis, to 124 lb., and the quantity of alkalies (potash and soda) subtracted from 1 acre of soil in the course of the year will be about 60 lb., and of phosphoric acid about 12 lb. It will be seen, therefore, that heavy manuring is absolutely essential, and Dr. Forbes Watson recommends that, even if it should be difficult to provide sufficient manure, the dry stocks, after the separation of the fibres, and all refuse during its preparation, should be carefully collected, burnt, and the ashes returned to the soil. If this is systematically done,

there need be no fear that Ramie as a crop will prove very exhaustive to the soil, as the proportion of valuable mineral constituents taken away in the fibre itself is quite small.

Harvesting.

Cutting the stems.—The stems should be cut before they turn brown and before they flower. In order to secure the maximum number of crops during the season, Dr. Forbes Watson recommends that the stalks should be cut when they attain a height of from 3 to 4 feet, as at this height, in addition to the other advantages, the fibre is not so coarse, and consequently more valuable. The following is a description of the method of harvesting followed in Formosa:—"The workman seizes each stem 9 inches above ground between the thumb and fingers of the right hand, snaps it over to the right, causing a fracture, lays hold of the stem below the fracture with his left hand, pushes down and sideways the upper part of the stem on the fracture to complete the division of the wood, inserts the forefinger of the right hand on the fracture, which is now compound, and draws it up between the peel on the left and the wood and adhering peel on the right, removing on its way branchlets, leaves, and tip. He then draws down the peel on the left with his left hand to the root, where it is readily detached. In like manner the peel and wood on the right are removed at the root, and the wood, being but loosely attached, can be readily separated from the peel. The whole operation is simplicity itself, and can be conducted with the greatest rapidity. The result of repeated timing is that 100 stems can be peeled without haste in fifteen minutes, that is, at the rate of 400 an hour. The peeled stems and discarded leaves, &c., remain on the field as manure.

"The next process is the removal of the cuticle and the bleaching of the fibre. The ribbons are made up into loosely-tied bundles, which are placed in a tub of cold water. When the workman is about to remove the green cuticle from the fibre, he places on the thumb of his right hand a wide copper ring, on which a small flat piece of bamboo has been fixed, the piece of bamboo resting against the face of the thumb. In the same hand he holds an iron instrument like a shoe-horn, in such a position that he can grasp anything between the piece of bamboo and the blunt inner edge of the hand instruments. A bundle of the ribbons is then taken from the tub and unfolded. Taking ribbon by ribbon from the bundle with his left hand he grasps it about 6 inches from the wide or butt end—the cuticle on outside of the ribbon against the piece of bamboo—and scrapes it to the tip. After a couple of scrapings the whole of the cuticle, with the exception of the 6 inches or so at the butt, is removed, and when ten or a dozen ribbons have been treated in this manner the workman reverses them, and removes the cuticle at the butt ends. The fibres, which remain in his left hand, are hung on bamboos in the sun to dry and bleach for six hours, when they are white and ready to be packed into bundles for market. One man can extract some 8 lb. weight of fibre in a day of ten hours, and an English acre of land yields about 900 lb. of fibre.

Yield.—It is estimated that each cutting gives 20,000 lb. of green stems with leaves, or 5,000 lb. of dry stalks, as the yield per acre, and the minimum product from dry stalks is 15 per cent., that is, 750 lb. of raw, merchantable fibre, or not quite 4 per cent. of the living stem and leaves. The caution must be given, however, that until the end of the first year, at any rate, when the roots have at length penetrated the soil, a full crop can scarcely be expected.

Properties of Ramie.

It has been definitely decided that Ramie fibre is considerably stronger than either flax or hemp. It has also the highest resisting power under the influence of moisture and various atmospheric conditions of any known fibre. Although strong and resisting, the fibres of the Ramie are as fine, if not finer, than those of flax. Whilst, therefore, as regards strength, resistance, and fineness, Ramie is either equal or superior to the best-known fibres, it has the additional advantage of possessing in a considerable degree a silky lustre. Jute, the only other fibre which can compete with it in this respect, is far inferior to it in strength and durability, as well as in its capability for bleaching and dyeing.

Uses of Ramie Fibre.

There is no fibre which, from its inherent qualities, has lent itself to such a wide range of experiments as Ramie. During the cotton famine produced by the American war it was utilised for admixture with cotton, and was spun and woven into different fabrics, which, as compared with pure cotton, are reported to have gained in strength, and to have acquired a certain amount of gloss, rendering them more similar to linen fabrics. Neither the spinning nor the dyeing gave rise to any difficulties. As a substitute for wool of long staple it has been found capable of being spun on worsted machinery, and then used like mohair, or other long-stapled wools, for the manufacture of certain kinds of fabrics which depend for their effect on the gloss of the material. Although everything which could be desired as regards appearance and finish, it was found that they became easily creased with wear, as the vegetable Ramie is wanting in the elasticity of wool. It has been used, though not to any extent, as a substitute for and for admixture with silk, but there are so many other directions in which its strength, lightness, and power of resisting moisture may be utilised that these speculations are hardly necessary. It would be a gain in connection with ships' rigging both as to lightness and saving of material in comparison with hemp, also for canvas and sailcloth instead of flax, and it is possible that some of the waste Ramie could be utilised in paper-making.

Dr. Forbes Watson says, in regard to the different uses to which Ramie can be put:—"This is due, partly, to the superlative degree in which it possesses certain qualities, such as fineness, strength, and lustre, not usually associated in the same perfection in any single fibre, and partly to the curious intermediate position which it holds between the usual vegetable and the animal fibres."

Mechanical and other difficulties in preparation.

There are still many difficulties to be overcome before Ramie will gain its proper footing in the world's markets. Considerable trouble has been caused by the variations in the fibre sent to market. Owing to differences of opinion amongst growers as to the proper height of the plant at which cutting should be commenced, and the difference in the growths of the first, second, and third crops, very uneven samples have been the result. The height already recommended—3 to 4 feet—doubtless gives the best results.

The other great difficulty is in obtaining a machine which is quite suitable to the preparation of Ramie for market in large and at the same time even

quality and quantity. The larger manufacturers will not take up the fibre under any other circumstances except on terms which would practically ensure them a monopoly. It is therefore with the second stage of preparation—the decortication of the Ramie stems—that the difficulty must first be overcome. If there could be an assured regular and even supply of Ramie fibre, then, doubtless, manufacturers would put up the necessary machinery to deal with it, but owing to the difficulties of decortication the industry is practically blocked. That such a machine will come into the market goes without saying, and already several inventors have come very near to success, so that the final working out of the idea is only a question of time.

Meanwhile it would be well for our farmers in likely districts to test the plant in a small way, so that in the event of a market being opened up they may be in a position to promptly step in and take advantage of it.

Colonial Timbers for Carriage-building.

Imperial Institute Road, London, S.W.,
10 August, 1894.

Sir,

You will probably have received from the Agent-General for New South Wales a copy of a memorandum, duplicate herewith, submitted by me to the Executive Council of the Imperial Institute, on the subject of a recent visit of a deputation from the Institute of British Carriage manufacturers to the galleries here. With reference to that memorandum, I have now the honor to forward, for the information of the Government of New South Wales, a copy of a statement by Mr. George N. Hooper, Past President of the Institute of British Carriage manufacturers, showing the qualities desirable in timber used for the different parts of carriages, and trust that the information which it conveys may prove useful.

I am, Sir,
Your obedient Servant,
F. A. ABEL,
Secretary and Director.

The Honorable the Colonial Secretary,
Sydney, New South Wales.

Memorandum by Mr. Hooper, of 107, *Victoria-street, on the qualities of Timber required for Carriage-building.*

One of the chief wants is wheel timber of fine quality, grown in, and very carefully seasoned in, a tropical climate, to enable British carriage-manufacturers to make wheels that will wear well on carriages sent to tropical climates.

The parts of wheels are:—

The stocks (centres)—in England elm is used.

The spokes (radii)—in England ash is used.

The felloes (circumference)—in England ash is used.

Each part requires woods of special quality.

The stocks must be dense and tough, capable of holding the wedges of the iron axle-boxes, and not liable to split.

The spokes must be hard, tough, and elastic.

The felloes must be hard and tough, and the grain of the wood should, if possible, follow the curve.

In London, stocks are sold by the pair, spokes are sold by the hundred, and felloes are sold by the hundred.

Boards 1 inch thick are sold by the square foot delivered.

The timbers now used in England, Ireland, and Scotland for footboards, boots, and rockers are—British elm, Canadian black birch, and Honduras mahogany. They are dense, fairly smooth in grain, and fairly tough. Widths from 16 to 22 inches.

Canadian pine boards, $\frac{3}{4}$ inch thick, are used for the bottoms of carriages, and are sold by the square foot. They must be absolutely free from knots, and bend easily. Widths from 16 to 22 inches.

Pine boards, $\frac{3}{8}$ inch thick, are used for carriage roofs, and same quality as above, sold by the square foot delivered. Widths from 16 to 22 inches.

Mahogany boards, $\frac{3}{8}$ inch thick, used for carriage panels, must be absolutely without figured grain and knots, must season without cracks absolutely, must withstand the action of water and moisture, be fairly dense, tough, and easily bent when steamed, are sold by the square foot, delivered at works (British Honduras). Widths from 16 to 36 inches.

Ash planks, for framing bodies and under carriages, poles, shafts, should be dense, very tough, fairly free from knots, and season without cracking (Great Britain). Planks should be from 14 to 22 inches wide, and the following thicknesses, 1 inch, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, $3\frac{1}{2}$, 4, 5, 6 inches.

In all cases the woods should be durable, and not liable to early decay through damp.

They should also not exude any sap, juice, syrup, or other substance that would prevent paint adhering, or alter or injure the paint and varnish.

The woods that seemed to find most favour among the experts were:—

New South Wales—White beech, red ironbark, spotted gum, grey ironbark.

India—Teak, Dalbergia sissoo.

Canada—Black ash, slippery elm, common elm, rock elm, red and black oak, black and white birch, shell bark hickory, black walnut.

Victoria—Blue gum (spokes), blackwood, box (stocks), ironbark (spokes).

Queensland—Red cedar (panels).

For commercial purposes the woods should have short, easy names, that can be easily spoken and written. Were the long botanical names used they alone would create prejudice, and perhaps prevent the timbers being used.

There is a demand for light carriages. Very heavy woods would therefore not be bought for carriage-building.

Woods should not be so hard as to be very difficult to work. The substance of some woods is gritty, and therefore rapidly blunts the workmen's tools. They are therefore objectionable.

I think I have fairly set out the kinds of woods now used here, qualities required, and manner of sale, and trust that advantage may arise and trade result.

GEORGE N. HOOPER.

Imperial Institute—Memorandum for the Executive Council.

A deputation from the Institute of British Carriage-manufacturers visited the Imperial Institute on Thursday, 28th June, 1894, for the purpose of inspecting the various timbers in the Colonial and Indian sections, and ascertaining their suitability for use in carriage-building.

The deputation consisted of the following gentlemen, who represented well-known and important firms of coach-builders:—

Name.	Firm.	Address.
Geo. N. Hooper	... Hooper & Co.	... 107, Victoria-street.
Percy Preston ...	... Holland and Holland... ...	... 479, Oxford-street.
A. E. Smith ...	... S. Smith & Co.	... Holesworth, Suffolk.
A. M'Naught ...	... .	Dingwall, N.B.
George J. Jacobs	... May and Jacobs	... Guildford.
S. C. L. Fuller...	... S. A. Fuller	... Bath.
Arthur F. Mulliner	... .	Northampton.
R. Harrison ...	... Harrison and Son	... 1, Stanhope-st., Euston Rd.
Robert Gates ...	... .	Gravesend.
Alfred Ferns ...	... Surveyors Department, Metropolitan Police.	
John Philipson, jun.	... Atkinson and Philipson ...	... Newcastle-on-Tyne.
J. E. Ridges ...	... .	Wolverhampton.
J. A. M'Naught	... M'Naught & Co.	... Worcester.
W. Deane ...	... Deane and Son	... Bedford.
E. Bailey ...	... .	2, Kilburn Sq., N.W.
G. Clare... ...	... Holland and Holland... ...	... 479, Oxford-street.
— Hunt... ...	... Holland and Holland.. ...	... 479, Oxford-street.
H. Thorpe ...	... Rock, Hawkins, and Thorpe	... 24, Baker-street.
Thos. E. Worger	... J. Worger and Sons	... Belgrave Mansions.
W. Miller ...	... J. Hooper & Co.	... 107, Victoria-street.
Andrew W. Barr	... Secretary, Institute of British Carriage-manufacturers.	

This conference of carriage experts entirely originated with Mr. G. N. Hooper, of 107, Victoria-street (coach-builder to H.M. the Queen-Empress, and to H.R.H. the Prince of Wales, Past President of the Institute of British Carriage-manufacturers), who, on a recent visit to the Imperial Institute, was struck with the large collection of timbers exhibited in its several sections. and who then conceived the idea of bringing these timbers to the notice of experts in the coach-building trade.

Mr. Hooper pointed out to his confreres at the meeting that in the manufacture of carriages for different climates the selection of suitable timber had become a question of great importance to the trade, as it was found that the woods which were well suited to a temperate climate were quite unsuitable for use in the tropics, and *vice versa.*

To direct more especially the attention of the visitors to those timbers which Colonial experience had proved to be the best suited for the varied climates of the colonies, lists of such timbers as were found to be valuable for carriage-building were prepared, with concise descriptions of the nature of the woods, and handed to the members of the deputation.

The deputation closely examined many of the samples of wood displayed, and were very favourably impressed with the collection, of the existence of which, prior to the visit, most of its members were quite unaware.

Now that the fact of the existence of the collection, and of the possibility of obtaining information respecting the various timbers exhibited, has become known to the carriage-building trade, individual members of that guild will find it advantageous to visit the Imperial Institute and examine for themselves the specimens of timber exhibited in its galleries, for which every facility will be afforded.

25th July, 1894.

The Oidium on Grapes.

By J. A. DESPEISSIS.

The annual loss to vine-growers, owing to the oïdium on the vines, may safely be stated to absorb in a great many instances the bulk of the profit which may reasonably be expected from the yield of well cultivated grape-vines. No reliable data are on record from which to estimate the shrinkage of the crops as due to this cause alone; it may, however, he put down as varying from 10 to 30 per cent. of the whole crop.

Of late years the oïdium seems to have been, if anything, on the increase, and even districts which were little affected by it, have seen it since in a very severe form.

Sulphur, in the powdered state, has hitherto been far away the most efficacious remedy against the pest, but the difficulty of applying it evenly in that form, as well as its short period of action, necessitating repeated applications, renders its use both costly and wasteful. Considerable damage is often brought on the grape crop by the oïdium, owing to the fact that vine-growers are compelled to wait for favourable weather to apply the remedy. On windy or wet days, for instance, the application of powdered sulphur would amount to so much money and time thrown away with little result.

For this reason, amongst others, it has often been suggested that, if it be true that the sulphur fumes are active agents of destruction of the oïdium, some solution containing sulphur in the liquid form might prove efficacious to the same extent.

With this object in view, I arranged last spring, at Rocky Mount, a series of experiments, with a view of testing what effect sulphur applied in the liquid form, as a spray on vines, would have in checking the appearance and spread of the oïdium.

Some vine-growers have suggested the use of a dilution of sulphur dioxide. This experiment I was about to begin, when a disastrous hailstorm, occuring about the middle of December, made it impracticable for me to test the value of the specific, inflicting considerable damage to the vines under observation.

At the same time, I had the intention of trying a solution of carbon bisulphide, which, when exposed to the air, readily dissolves into carbonic acid gas and sulphur dioxide, but owing to the same unfortunate reason, I was compelled to give up the experiment.

The third experiment I was so far successful to carry out, although further tests next season would be desirable to fully ascertain its value.

The same severe hailstorm which prevented the other experiments being carried out, established the great power of adhesion to the leaves offered by the liquid prepared according to the following formula:—

Sulphate of copper	2 lb.	Sulphide of sodium ...	2½ lb.
Lime	½ ,,	Water	20 gallons.

The solution was thus prepared:—

(*a*) The sulphate of copper having been dissolved in about 2 gallons of warm water, the lime was reduced to the consistency of paint, and then added to the first solution, and stirred up as when preparing Bordeaux mixture.

(*b*) The sulphide of sodium is likewise dissolved in a bucket of water, and gradually poured into *a*, stirring all the time, and water up to the 20 gallons added, when the mixture is ready for spraying. Twenty gallons per acre are enough for the first spraying of vines planted 8 ft. x 7 ft., and about 25 for the subsequent ones; the cost of material amounting to about 3s.

The experiment was carried on white Muscat vines, which are notably subject to both oïdium and anthracnose or black spot.

A couple of rows were left untreated, for the sake of comparison. Two rows received one treatment only. A few rows received two sprayings. The remainder were sprayed three times, viz.:—

1st. At the time the shoots were a few inches high.
2nd. As soon as ever the flowers had set.
3rd. Three weeks later.

Up to the time of the storm, no signs of disease was showing on the vines treated three times. Very sparse indications on those treated twice, while those treated only once, were as badly affected as were the vines left without treatment.

The vines, I must say, had been treated towards the end of the winter, a couple of weeks or so, before the buds began to burst, with a concentrated solution of sulphate of iron, with a little sulphuric acid added, to keep down the black spot, which showed sparingly, with the exception of those rows treated three times, which were completely free from this disease.

At vintage time I noticed a better crop on the vines that had been treated, although, owing to the fact that no treatment had been applied from the beginning of December until the time the grapes were picked, some oïdium began to show up, some time in January, but did little injury to the grapes.

To sum up:—The application of sulphur in the liquid form had the desired effect in checking the oïdium.

The mixture showed likewise a beneficial effect in checking black spot.

It can be applied even when the weather is not propitious to the application of powdered sulphur in the usual way, and its effects are more lasting.

The cost was about the same as in the case of sulphur, although I have reason to believe it could be made cheaper.

I purpose next season to repeat the experiments under, I hope, more favourable circumstances, and settle definitely the respective merits of applying sulphur in the powdered and in the liquid form for combating the oïdium.

Another sulphur preparation I also tried on a few vines, with highly satisfactory results. It consists of a sulphur emulsion in the form of a pomade which is simply diluted with water and sprayed in the ordinary way. The experiment was undertaken at the request of Mr. George Payne, who last year visited the Colonies for the purpose of introducing the cultivated yeasts in wine fermentation, and the emulsion was supplied by Mr. Penfold of Newcastle

Notes on Insect and Fungous Pests.

BY C. T. MUSSON,
Hawkesbury Agricultural College.

QUARANTINE.

Our chief Insect and Fungous pests have been imported from other countries.— Bearing this in mind, together with the fact that such pests are constantly spreading, not only by means of such natural methods as they themselves possess, but helped to a large extent by man in the general course of his various occupations, we should adopt some strong Quarantine measures in order to prevent the incoming of pests and to put an end as far as possible to the spreading of such as we are unfortunately already cursed with.

In California, according to French in his handbook of the Destructive Insects of Victoria, Acts exist authorising the establishment of a Commission to protect the fruits of the earth, and giving authority to appoint officers who shall take in hand the subject of protecting the interests of Horticulture and Viticulture. The main provisions are as follows, in a condensed form.

(1.) All tree or plant cuttings, grafts or scions, plants or trees of any kind infested by any insect or insects, or the germs thereof, namely, their eggs, larvæ, or pupæ, that are known to be injurious to fruit or fruit-trees, and liable to spread contagion: are required to be disinfected before removal for distribution or transportation, whether offered for sale or gift.

(2.) All trees or plant cuttings, grafts or scions, plants or trees of any kind imported into this State from any other State or from any foreign country are required to be disinfected immediately after their arrival and before being offered for sale or removed for distribution or transportation, unless a clean bill of health is certified to by an executive officer appointed for the purpose.

(3.) Fruit of any kind infested by any species of scale insect or insects, or the germs thereof, namely, their eggs, larvæ, or pupæ, known to be injurious to fruit and fruit-trees, and liable to spread contagion, is required to be disinfected, before removal off premises where grown whether for the purpose of sale, gift, distribution or transportation.

(4.) Fruit of any kind infested by any insect or insects or germs thereof, namely, their eggs, larvæ, or pupæ, known to be injurious to fruit or fruit-trees, and liable to spread contagion, imported into this State from any other State or from any foreign country is prohibited from being offered for sale, gift, distribution or transportation. (This includes fruit infested by Codlin Moth.)

(5.) Fruit boxes, packages, or baskets used for conveying fruit to any destination, are required to be disinfected before being returned to any orchard, store-room, sale-room, or place to be used for storage, shipping or any

other purpose. Transportable material of any kind infested by any insect or insects known to be injurious to fruit-trees or fruit and liable to spread contagion is prohibited from being offered for sale, gift, distribution or transportation.

(6.) Particulars are given as to how disinfection may be carried out, both for trees, cuttings, &c., and cases or packages. Owners of fruit of any kind are required to procure certificate of disinfection before distributing their fruit, if the orchard from which it came is infested with insects, or the fruit shows any sign of the presence of pests. Any fruit, trees, cuttings, boxes, packages, and other material, used in violation of the quarantine rules and regulations for the protection of fruit and fruit-trees, may be seized either for disinfection or destruction, under certain stated penalties, for violating the said rules and regulations.

Such, in outline, are the regulations established in California. Recognising the prevalence of crop pests, and the disastrous consequences resulting from their unchecked sway, energetic measures, as advised by competent persons, are adopted and stringently carried out by a staff of State officers whose duty it is to administer these laws.

We in N. S. Wales have no law for enforcing what we may term general quarantine against insect and fungous pests, for the latter should be included with insects as pests, in any general scheme for relief; and although it may seem strange, knowing the damage that is yearly done by such pests, up to the present we have taken little or no trouble in trying to prevent them from taking their own course. Food supplies are destroyed or considerably deteriorated in value owing to their prevalence, and an important branch of industry seriously interfered with. In the cases of Phylloxera and Codlin Moth, the former has forced on State interference, and the latter will apparently do so. It would seem as though we are only just waking up to the fact that the onward march of these pests may be very largely arrested. When pests become very bad we endeavour to bring about State interference, and solicit special aid in putting down what we should ourselves have prevented from obtaining a foothold. I call to mind an instance—the Blackthorn (*Bursaria Spinosa*) is at present suffering, on the slopes of the Currajong Range, from the attack of a greasy scale. Three years ago the insects were few in number, to-day many of the bushes along 2 or 3 miles of road are thickly covered, and in some cases look as though covered with snow. Within the last few months it has been traced over a considerable extent of country, and has been found attacking a wild Solanum and a Croton. This insect also encourages the presence of *Fumagine*. Now, insects do not readily change their food; but when absolutely obliged to do so, or perish, they will. It does not need more than an ordinarily endowed mind to see that there is danger of this pest on our native bushes passing into the orchards. Once established on any cultivated fruit-trees, it will prove a serious thing. Obviously, for the good of all, it is the duty of someone or other to see to this. Whose duty is it? The growers might have had a "bee," assemble one day, cut down all diseased bushes, and stacked them; these could be burnt after a couple or three days' drying. Unfortunately, everybody's business is nobody's business, and now it is too late.

Growers have a great power in their hands if only they would combine for the purpose of combating crop-pests, or eradicating a pest that might possibly become serious, as in the above-mentioned instance. Combination for this purpose could well be carried out under Local Government Boards, by Irrigation Trusts, Fruit Growers Associations, or by Agricultural and Horticultural Societies. To me it appears that far more lasting good would

be done if time and money were devoted by the numerous societies to solid work in connection with combating crop-pests, instead of wholly to shows.

Some condition, insisting on work of this kind being done, might with propriety be attached to the securing of Government grants. No system would, however, be ideally perfect unless enforced by the central authority. To do real good the co-operation must be complete; one man refusing to carry out what are only the common laws of hygiene in connection with plants might nullify the work of a district. Plants, though unable to explain their own troubles in words, show such evidence of disease at times as should lead us to do what we can to help them. We cannot eat diseased food, nor should we give it to our farm animals, for it must be detrimental to them, although as far as we can see, no ill results accrue. If as much attention could be paid to plants as we pay to animals we should not have half the disease that is at present rife amongst our crops; the chief troubles would be suppressed on their appearance. "Plant-doctoring" will, unless we reject what common sense advises, be just as much in request in connection with plant-diseases as is veterinary science amongst animals.

In treating plant diseases, however, we are at great disadvantage. External troubles are much more easy to deal with than internal, whilst the course of life in many pests is such that they are exceedingly difficult to cope with. In very many cases it is prevention that has to be aimed at, owing to the fact that our present want of knowledge does not admit of a cure.

In carrying out such common sense precautions as are recommended by present-day knowledge and experience, we are operating against all classes of diseases to the best of our ability. We know, in connection with man and the rest of the animal kingdom, that cleanliness has a very important bearing on health. We may say with respect to the vegetable world, "Clean ground and clean plants will mean a clean bill of health"; and if any action of ours can favour this position with regard to our useful plants we should surely carry it out.

We must not think, however, that troubles can always be prevented from coming to plants; notwithstanding constant care and attention (from a Pathologic point of view), plants will be attacked, they will suffer from disease; we cannot keep them entirely free any more than we can prevent human beings from suffering. Life on the earth is so balanced that we must inevitably pay, through our crops, a certain toll to insects and fungi, not to mention birds, mice, and numerous other animals. We can, however, keep the loss within reasonable limits if we choose to do so; and for the good of the community if this is not done of our own free will and by the exercise of our own common sense, legislative authority must certainly step in and insist most rigorously on certain hygienic rules being carried out with regard to food-producing plants.

It is not my intention to expand further upon this aspect of the question, abler pens must take the matter in hand. I doubt not, however, but that, in the not very distant future, this country, endowed by nature with just the climate or different climates most favourable for healthy life and rapid propagation in insect and fungous pests, will be provided with such a scheme of operations, sanctioned by law, as will effectually put a stop to the encroachments of such organisms as at the present time seriously militate against successful cultivation.

It is my desire, however, to offer a few practical suggestions, not by any means original or new be it noted, as would enable, if carried out, any Association, Trust, or Society, to keep their respective districts tolerably clear; and certainly to a great extent, safeguard such districts against pests

foreign to them. Individuals carrying out these suggestions would do much good, not only in the way of keeping their own places clean, and benefiting thereby, but their example would be noted by others who would speedily follow it, especially if successful results accrued; and they must accrue if the operations are persevered in.

Suggestions for carrying out Quarantine against Insect and Fungous Pests.

For want of a better we continue to use the old word Quarantine for the purpose of describing generally any process or processes by means of which we hope to prevent the incoming or spreading of insect and fungous pests. The actual process of treating any trees, cuttings, seeds, cases, and packages in order to kill such pests, whether seen or suspected, will be termed "Disinfection." In the first place it should be taken for granted that all trees, cuttings, seeds, cases, packages, or other articles used by growers, brought into a district from another district, be it near or far away, or into the country from another country, are unsafe to use unless treated for the purpose of killing insect or fungous pests that may be harbouring on or in them. Careful examination, even by an expert, will not always reveal the presence of pests. The only safe way is to disinfect them, and then no mistake can be made, or at least we render assurance doubly sure. It has been already remarked that nearly all our serious pests have been imported.

Basing the following remarks upon the above general assumption:—

1. All seeds should be fumigated or steeped in some liquid, for the purpose of killing any insects or fungi attached to or in them. Weevils often harbour in wheat grains, beans, and other seeds. Cereals are, or should be, invariably soaked to kill smut-spores. Flax seed coming into the Colony from abroad has developed in the grown plant a serious rust disease. If one operation only is performed it should be the latter; sometimes both are carried out. Clover seed would, if put in a sieve of the right mesh, lose its frequently contained dodder seeds. Wheat and oat crops often contain an admixture of darnel, this could be prevented by sifting. Steeping should always be carried out.

2. Pest-resistant varieties should be selected whenever possible. Reject such as are known to suffer severely. Much may be done by careful selection when planting, a rule not by any means carefully followed. We are apt to grow for quantity rather than quality; in growing for quality, however, we not only obtain a smaller return (higher prices make up for this), but we help the trees and through them ourselves, for the trees do not expend so much of their energy when yielding moderate crops as when the crop is heavy and consequently, all other circumstances being satisfactory, are stronger and healthier and better able to resist disease.

3. All young trees, cuttings, scions, and such plants as are to be used should, before being brought into an orchard, be disinfected. It is safer to carry this out under all circumstances whether they appear diseased or not.

Potato tubers for seed should be carefully examined, and if necessary dipped in corrosive sublimate, 2¼ oz. to 15 gallons water, to kill spores of scab; if there is any sign of the moth, a serious pest, they should be heated in dry air to 165 degrees Fahr., or soaked for such a length of time in some liquid, as water with a little carbolic acid in it, as will, without impairing the growing power of the buds, kill any contained larvæ or pupæ.

4. All packing cases should, before entering the orchard, be dipped for two minutes in boiling water containing one pound caustic potash or soda to each twenty gallons of water.

5. To provide against travelling insects. In case of caterpillars, such as the army worm, which travel in immense numbers in search of food, the rate of advance gives sufficient time for a deep furrow to be ploughed across the line of march or round a crop, the land side next to the crop endangered, to be undercut by means of a spade so as to present an overhanging wall up which the grubs cannot crawl. As they accumulate they should be buried in deep holes dug in the furrow, or killed by means of boiling water.

To provide against travelling locusts is more difficult, as they travel much faster, especially if in the perfect state as they then possess wings.

Orchards may be provided with lines of plants, disliked by the insects, growing along the threatened sides (locusts mostly travel in certain directions from their breeding grounds, which in N. S. Wales lie in the S.W.), such as castor oil or larkspur. A line of fires giving dense smoke will turn them. Wide strips of grass or other green food across their line of march may be poisoned with Paris green. Such attacks do not last long, but the results are disastrous if the insects succeed in making an entrance. Once in the crops ordinary methods of destruction have to be adopted. In Cyprus, where they abound, calico fences, with strips of indiarubber cloth along the upper edge, are erected. The insects cannot surmount the rubber strip and are killed as they accumulate. In any district especially liable to this pest some such means should be adopted to try and keep them out as are here mentioned.

6. All imported fruit should, if found to be diseased, be destroyed by fire. (Only under a special law could this be done, however. We must admit that no such fruit should be allowed to be sold unless first disinfected.)

In addition to carrying out the above general plan of operations, those desirous of doing their utmost to keep pests down (and this should include all growers) would need to follow strictly all the fundamental rules established by common consent as necessary to good cultivation. Unfortunately, speaking generally, too little attention is paid to such details—now it is above all things attention to the necessary details that will enable us to keep in check insect and fungous pests. Reasons can very easily be given showing the advantages gained under careful attention to such things. Although these matters are more particularly connected with cultivation, the result of following them out thoroughly has an important bearing on our immediate subject. Let us therefore summarise them briefly, adding a few remarks from the pathologist's point of view.

(*a*) *Rotation of Crops.*

If insect-pests are accumulating, a change of crop means starvation to them, they must move away for their favourite food or die; moreover, some crops are distinctly disliked by ground insects, *e.g.*, mustard.

(*b*.) *Use of Chemical Manures.*

These are distinctly beneficial, as they drive away insects or prevent them laying their eggs. Farm-yard manure should not be used unless thoroughly rotted, for two reasons: Firstly, it harbours numerous insect-pests; and secondly, the spores of fungi, in many cases, retain their germinating power, even though they have passed through the stomachs of animals. Consequently, smutty-oats fed to stock will, to take only this single case, possibly

be the means of inoculating a succeeding crop with the disease, if the manure is spread on the ground without thorough preparation. Diseased apples, potatoes, or root-crops fed to pigs or other animals should always be cooked first, otherwise contained spores may enter the resulting manure uninjured as to germinating power.

(*c.*) *Change of seed.*

Seed should always be obtained from reliable people, who will certify it to be clean; moreover, it should not come from a district where disease is rife; for instance, oat-seed procured from a notoriously smutty district, would certainly bring smut, and although steeping in bluestone keeps the pest down, it is better to get clean seed straight off. It is a well-known fact that constant use of one strain of seed, whether maize, potatoes, or any other, tends to degeneration in the resulting crop.

(*d.*) *Clean cultivation.*

Weeds notoriously harbour pests, many an insect is kept alive by weeds until the favourite juicy crop-plant is ready. Many fungous pests are to be found all the year round on certain weeds; although we may see, as a rule, no harm done, sooner or later there comes a time when the pest becomes epidemic, serious loss resulting. Rubbish gives harbourage to insects, the field-cricket for example. Mulching, however, must at times be resorted to, but unless judiciously used, and properly attended to, it may be the means of collecting numerous pests which otherwise would be much less concentrated. Rubbish should be burnt; potato tops, cabbage stumps, and leaves, maize-stalks, stubble, should all be burnt; there is nothing like fire for cleansing; if left on the ground we are doing just exactly what the insects would ask us to do; providing them with the wherewithall for food and shelter. A real operative Noxious Weeds' Bill would be most beneficial.

(*e.*) *Thorough drainage.*

Many insects like moist earth; fungi abound in moist places; too much water in the soil may cause disease in plants. Irrigation, however, is a valuable means for clearing vineyards and cultivated ground from root-haunting pests, drowning large numbers of them; moreover, good drainage contributes largely to healthy growth in plants.

(*f.*) *Timely application of suitable remedies for such pests as make their appearance* is most important.

Notwithstanding the careful carrying out of all these precautions, pests may, and will, appear; it then only remains for us to apply those remedies that have proved most satisfactory under similar circumstances, in order to try and prevent the trouble spreading. It is sometimes found that insects naturally feeding on certain native plants may, if their ordinary food runs short, change their habit of life and attack some crop; consequently a sharp look out should always be kept for such prospective dangers, and when necessary immediate measures taken; numerous instances of this state of things could be mentioned as occurring in our own Colony. Some insects are useful to us as being parasitic on other insects, for instance, the true ladybirds, ichneumons, many flies, and some plant-bugs. It may be noted that this class of insect (useful) is much more numerous than at first sight appears to be the case. All natural insect enemies should, therefore, be encouraged by every means in our power.

Some fungous pests it seems impossible, with our present knowledge, to deal with satisfactorily; amongst them, rust in wheat and putrefactive mildews on various plants. In such cases our energies must be concentrated in the direction of *prevention*, chiefly through the use of resistant varieties.

The question remains, will it pay to take all this trouble? Emphatically, yes! ***We must not look upon such measures as entailing trouble, but as being necessary work;*** quite as important in its own way as the putting in of the seed, supplying manure, or even erecting fences to keep stock out of our crops. Great difficulty would be experienced in putting *thorough quarantine* in force unless under authority from Parliament, and by officials appointed for the purpose, more especially in any old established district; but in any district where, for instance, fruit-growing is entered upon as a new industry, any Association, Trust, Society, or Local Board, would (or should) have the power (and would certainly have exceptional opportunity) to establish such a system of supervision over imported requisites as would render the district comparatively secure against attack from outside. All cases of pests appearing should be reported within twenty-four hours to a responsible officer, who should have power to put into operation at once the necessary remedial measures without the delay attendant on committee and other meetings. A special quarantine sub-commitee of two or three members should be appointed; spraying machines could be obtained on the co-operative principle, and a stock of necessary materals kept on hand. The initial expense might be borne by the organising power, and a small fixed charge made for their use, and for keeping the machine in repair. All such details as might be required for the working of such a system could readily be arranged. I think it will be seen that the necessary measures for securing the end in view are only possible under friendly co-operation or Act of Parliament. There can, however, be no doubt about the fact that, systematically carried out, strict quarantine would most certainly protect our crop-plants against all the more serious and important pests.

It remains only to add, in conclusion, that these "notes" only give an outline of the subject, which well deserves the attention of all interested in the important industry of food-raising; suffering as it does such severe losses from the attack of innumerable insect foes and fungous pests.

Entomological Notes.

By C. T. MUSSON,
Hawkesbury Agricultural College, Richmond.

Mites, Ticks, and Lice.

It is desirable that we should know something about the Australian forms of these animal and plant pests. There is difficulty attending their preservation and examination; being very small in most cases, the unaided eye can do nothing; by means of the microscope, however, they can be examined and recognised. Strange as it may seem, these minute creatures are remarkably interesting when they are carefully studied and their life history becomes known.

Mites.

Of the mites, it may be said they are wingless; when perfect have eight legs, in the early stage only six; belong to the order of Spiders, forming a group known as the "Acarina"; there is no metamorphosis, the eggs on hatching produce young mites, which undergo very little change save in the addition of one pair of legs. Amongst them are red spider and other spinning mites most frequently living on plants; harvest mites occurring amongst plants, often in hay; a large group known as *gamasids* living either on the ground in damp places or parasitic on animals; a group of freshwater, and another of marine forms; one large section found attacking insects; another, *acaridæ*, found parasitic on birds, in cheese, on insects and animals, amongst them the itch and louse mites; and a large group attacking plant, leaves and flowers, causing leaf and bud galls. The species are numerous. To get rid of them it is necessary, in animals, to establish cleanliness and treat the parts affected with tobacco water, or the same with a little sulphur added, or sulphur and vaseline, or sulphur and lime, or kerosene diluted with milk or warm water, and well stirred. Plants attacked should be sprayed regularly with soap and sulphur emulsion or kerosene emulsion. Operations being commenced at an early stage would in most cases end successfully.

Ticks

Belong to the same order. Their bodies are covered by a tough, smooth, leathery skin, which in the female is capable of much extension. They have eight legs, and their mouth parts are adapted for sucking. Some are blind, others have eyes. They live in woods and on herbage, and though their habit is at first to live on plant juices, they attach themselves to animals that pass within reach, burying their front parts in the flesh, sucking the blood; attacking dogs, cattle, horses, wild animals, and man; sometimes, in case of dogs and cattle, with serious, even fatal, results. (The common

sheep tick is an insect belonging to the *Diptera*; it is a fly, minus wings, and adapted to the parasitic mode of life.) The species are not very numerous; it may be remarked, however, that the group has not been carefully studied. In case of attack (the pain is described as being like a burn with red hot iron, and personal experience confirms this) cut the insect off as close to the attacked skin as possible, and put on the place a little turpentine, olive oil, or kerosene; the head works out with little ill effect, the wound soon healing.

Lice

Are hexapod insects; now placed for convenience among the *Hemiptera* (plant lice, bugs, and scale insects). They have no true metamorphosis, in early life much resembling the perfect state; they have no wings, and their mouth parts are adapted, in some of them, for biting, in others for sucking. They are all parasitic; the biting group feeding on the hair and feathers of their animal hosts; largely found on birds. Of the blood sucking group there are numerous species, occurring on various domestic and wild animals. To keep them away cleanliness is very necessary. Birds adopt the "dust-bath" as a natural means of cleaning themselves. In case of attack, wash the affected parts with tobacco water, or the same with a little sulphur mixed, or vaseline and sulphur, or kerosene diluted with milk thoroughly mixed.

The writer would be glad to receive specimens of all such insects as have been mentioned, for investigation; indeed, *the main purpose of this note is to draw attention to the fact that amongst these small pests there are many that seriously affect the plant and animal economy* (whilst they are with us very imperfectly known), and to request the forwarding of specimens for investigation into their habits and a study of these interesting but often noxious pests generally.

Specimens can be forwarded in small tin or wooden boxes, or, better still, in bottles, preserved in methylated spirit, or even whisky. For safety, bottles should be packed in a mustard or other tin, or singly in small safety tubes made out of a piece of kerosene tin; or in a piece of soft wood in which a hole has been drilled of the required size. It need hardly be pointed out that they should be tightly corked and securely packed.

Different parts of an animal frequently support different kinds of lice or mites; such as are obtained under these circumstances should, therefore, be kept separate. In all cases particulars as to locality and general circumstances relating to the specimen should be attached.

Agriculture in the Lower Yang-tse Basin.

By F. B. PARKINSON, A.R.S.M.
Late Mining Engineer to the Chinese Government.

Considering the crude state of the roads, and of industries connected with mining, it would be impossible for China to support her vast population unless the culture of food stuffs was kept at a high standard of efficiency.

The general character of the country from Shanghai to Hankow, and for 100 miles on each side of the river, is that of rich alluvial plains traversed by ranges of hills having usually an east and west trend.

Wherever possible rice is the Chinaman's greatest ambition, but every inch of these 120,000 square miles that is not actually bare rock is made to produce something. The tops of the highest hills give the best tea, and where the ground is too stony for this, fir and oil trees are planted in regular rows, which yield oil, resin, timber, and firewood. On the lands of intermediate height, or where the soil is too porous to hold the water during the growth of a rice crop, cotton, wheat, maize, buckwheat, sweet potatoes, and culinary vegetables are made to grow in great profusion. A comparatively insignificant area is devoted to pasture, and the chief part of the cattle kept are for use behind the plough. A few sheep and goats graze over the burying-grounds, or, guided by children, eat the herbage from the puddled-clay divisions between the paddy-fields.

Dairy-farming is quite unknown in these provinces and milk is looked upon with disgust by all the Chinese I have met here. There is, however, an Englishman in Hankow who keeps a dairy to supply the European Settlement, and his products seem to be very fairly good. He complained to me of constant losses among his imported cattle during the summer months, though from what causes he could not clearly explain. Probably he had not the kind of stock best adapted to the climate, as I have never heard of much disease among the Chinese cattle. The water Buffalo is the most useful beast for the cultivation of rice, as his immense strength enables him to do a long day's work knee deep in mud, and he can feed well along the swampy borders of lakes, where ordinary cattle would be lost in the bogs. The milk of these beasts is not so rich as that from an ordinary dairy cow, but it is just as wholesome, and I have used it constantly mixed with goat's milk. Their flesh is somewhat coarse, but the flavour is good, so that rissoles and sausages form a very pleasing transformation of an old bull who has daily earned his mud bath and fodder by years of labour.

Thus, then, the Chinaman is almost entirely dependent upon night-soil for manure, and he is very vigilant in securing every particle for his crops. The farmer purchases large quantities of glazed earthenware vessels, about 2 feet in diameter; they cost about 2d. each, and these he locates along footpaths, or wherever people are likely to pass, and erects a neat roof of bamboo and

Note.—This contribution is of interest, as showing the value of night-soil in cultivation. The night-soil of Goulburn is all utilised for orchard and vegetable growing, but the preparations are somewhat less unsavoury.—Ed.

rice-straw over them to protect them from the rain. The manure is gathered every morning, mixed with earth, and made into piles ready for use. In large towns the removal of manure to the country becomes a serious matter, and gives employment to armies of coolies, who sell it to the farmers.

Hankow, Han-yan, and Wuchang, the three cities crowded at the junction of the Han and Yang-tse Rivers, and containing certainly over a million people, all possess pieces of ground set apart for the preparation of manure. Here, in the early morning, swarms of coolies issue from the city gates, each carrying his two large buckets slung from the ends of a bamboo, and racing up a plank discharges them into one of the huge crater-like mounds of earth, prepared by children and old men, who constantly work on the spot, and as soon as one of the craters is full they throw in more earth and tread the mass with their feet into the consistency of dough. Naturally the condition of the atmosphere at these places would prostrate the strongest advocate of the dry-earth system, but truly the details, and not the system, are here at fault. When the mass has become sufficiently mellow, it is either carried in baskets to the nearer fields, or shipped in junks to where it is required, for in this region there is scarcely half a dozen miles without a creek or lake navigable to vessels of light draught.

In this manner the distribution of the manure is secured, and it is needless to add that for land which has been so long and persistently cultivated it is as vital to success as the sowing of the seed itself.

Three crops can generally be secured from the land in a year, though in some severe seasons the winter crop may become damaged by snow and frost for a week or two in January. The usual order of things is the following:—

For paddy-fields—
- Rices—May to August.
- Maize—September to November.
- Vetches, &c.—November to April.

These winter crops are generally ploughed in or partly consumed as green fodder for the buffalos and draught cattle.

For other fields—
- Wheat or other grain—February to May.
- Cotton—May to September.
- Roots and other plants—September to January.

In some districts indigo and opium are much grown, to the exclusion of other crops, but it is not the general rule. Most housewives like a few indigo plants near at hand, sufficient to make a vat of dye for the clothes of her family. Any other colour is rarely seen in these provinces.

The plants are macerated in wooden tubs, and the resulting indigo is reduced with ferrous sulphate and lime in order to render it soluble. I have made many inquiries, but could never satisfy myself whether this process was really originated by the natives or whether they have learnt it from foreign sources. The ferrous sulphate which they use is also a mystery, and I do not know from what source they procure it. Judging, however, from its crude condition, and the ease with which it may be procured from any little shop in the most out of the way places, one would take it to be a native product.

It would be impossible to overrate the value of the bamboo to the Chinaman. Little labour is required to cultivate it, as once planted it continues to produce for generations, and the occasional stocking up of an old root is all that is required to keep the bed in order. In many respects the bamboo takes the place of metals, and I would venture to suggest that although the

Chinese have been acquainted with iron, copper, and brass from very early times, yet the bamboo has played an important part in preventing these metals being so generally used, as among Western nations. For coopering tubs and other wooden vessels, for joinery—indeed, in every case where we would use nails, wire, or hoop-iron,—the Chinaman can use bamboo. The young shoots make an excellent vegetable, and paper and twine of great strength are produced from its fibre.

Although their implements appear of rude construction at first sight, yet on closer acquaintance one is forced to admit that they are fairly well adapted to the needs, and the final results scarcely leave anything to be desired. The fields are all cultivated like gardens, and the crops when growing are kept well hoed and cleaned of weeds. It is worthy of remark that all their tools with cutting edges, such as hoes, picks, sickles, pruning hooks, &c., although of purely native manufacture, are all steeled and tempered on the edge.

It may, perhaps, not be without interest to some to follow the details of the practice in the case of two of their most important crops, namely, cotton and rice.

In the case of cotton the seed is first mixed with dry earth to prevent their sticking together; slight cavities are then made in the ground about 2 feet apart between the rows of wheat, and three or four seeds thrown in in each and lightly covered, and then a small teacupfull of an emulsion of manure in water is poured over. After the wheat is cut and the cotton about 4 inches high, it is hoed and thinned out so as to leave one or two plants at each setting, and then another dose of emulsion is applied round the roots. No more care is now needed till the cotton is ready for gathering, and it is just at this time, from June to August, when everything is growing under tropical heat and moisture, that the farmer is at leisure to collect and make stores of manure for the next crop.

Rice is more complicated, but may be roughly described as follows:—The seed, rolled up in straw bundles of about 50 lb. each, is steeped for twenty-four hours in water and then thickly sown on a patch of highly manured ground, and the other fields ploughed up and water run in to the depth of 2 inches. When the rice has grown in the bed to the height of 6 inches the fields are harrowed till they are worked into a thin mud, which settles in a few hours perfectly level. The rice plants are then removed in handfuls from their birthplace and transplanted out singly about 18 inches apart in the fields that have been prepared for them. This operation of transplanting requires great beating of gongs and firing of crackers to be successful.

In about a month the crop is 18 inches high, and it then begins to turn a sickly yellow colour; slacked lime is then sprinkled on, and in a couple of days it is turned dark green and flourishes rapidly. I am not quite sure of the actual use of the lime, as it appears to be equally necessary on all soils, and I can only suggest that it acts by killing the millions of shrimps and small fish which swarm in the water, and which perhaps rob the plants of nourishment while alive, but when dead their bodies replenish the store of plant-food again.

The supply of water must be kept up until the grain is thoroughly ripe; it is then run off, and two days after it is reaped with a sickle.

At the time of rice harvest the dry season has already set in, and the Yang-tse is rapidly falling, but the running of the water off the paddy-fields is so simultaneous over the country that the river always rises 2 or 3 feet for a week and then goes down again.

Horse-breeding for Military Remounts.

NEW SOUTH WALES MILITARY FORCES.

Head Quarters, Sydney, 4 September, 1894.

From Major-General E. T. H. Hutton, C.B., A.D.C. to the Queen, Commanding Military Forces, to the Minister of Mines and Agriculture.

SIR,—In reply to a verbal request of Mr. Campbell, Department of Agriculture, I have pleasure in forwarding to you an extract of a paper read by me on the 28th ultimo, in which I have alluded to the horse supply of Australia. My motive for doing this is to invite the attention of the Government to the fact that in the opinion of many leading authorities in the Colony, and of myself, sufficient attention is not being paid to the breeding of the horses for domestic purposes, and that the quality of such horses is, in consequence, gradually deteriorating.

There can be no question but that a very important industry in this Colony, and in the other Colonies of Australia, is seriously threatened, and an export trade in horses, which should be the specialité of Australia, is likely to become less and less as years go on!

The Indian Government are now beginning to breed large numbers of horses for the use of the Indian Army, and the Indian horse trade for military purposes may, in consequence, be expected to decrease every year. It will be necessary, therefore, to create a market for Australian horses elsewhere, and I have endeavoured, in the remarks made on the 28th, to show that a great and increasing trade in horses for military purposes at the present moment presents itself in Europe, which, if Australian horse-breeders will only consider and develop the class of horses existent in Australia, should become not only a source of wealth to Australia, but should also directly benefit this continent, by encouraging a pastoral industry of great value.

The climate, soil, capital available, and the excellent thoroughbred stock existing in Australia, alike contribute towards making Australia generally a horse-producing country.

The facilities of shipment to Europe yearly become greater and simpler, so that horse-producers in Australia should be able to command the European horse market over the heads of South America, North America, Syria, and North Africa. The horses of the two former countries have not the blood nor the fine qualities of the Australian horse at his best, while the horses of the two latter are small and too slow for military, or even for general use for domestic purposes.

I beg to say that I have photographs made of the four types of horses to which I have alluded, which may serve to illustrate my points.

I venture to think that some initial steps should be taken by the New South Wales Government in concurrence with the other Australian Governments, firstly, in putting a tax on "stallions," so as to restrict the breeding from weakly, useless sires; and, secondly, that the Indian Government and the Imperial Government should be approached with the view to a Remount

Purchasing Agency being established in this Colony, presided over by a carefully-selected Imperial officer of experience.

Such an agency would at once create a market for the very horses which I have described, and establish the requisite standard which Australian breeders should endeavour to reach in order to command the military horse market of Europe. This system would speedily develop the European horse trade throughout Australia, the importance of which I have in my remarks on the 28th endeavoured to emphasise.

I have the honor to be, sir, your obedient servant,

EDWD. T. H. HUTTON, Major-General and A.D.C.,
Commanding Forces, New South Wales.

Extract from Lecture by Major-General Hutton, delivered at the rooms of the Royal Society, Sydney, under the auspices of the United Service Institution of New South Wales, on Tuesday, 28th August, 1894.

Let me close my remarks by reminding you that the mobility of mounted troops for strategical purposes must be necessarily in direct ratio, namely, to the quality of their horses. It is a fact, I fear, only too patent to any careful observer, that the Australian horse is gradually deteriorating in bone, sinew, and, therefore, in staying power—in all those qualities which go to make a horse valvable for military purposes, and, I might add, for domestic purposes also. It is a subject which should engross the earnest attention of everyone interested in the future of the Colony, namely, to consider what means should be taken to arrest the tendency to breed light, narrow, thoroughbred horses capable of nothing more useful than to win a six-furlong race. A future generation will, I fear, have serious occasion to rue the slight heed paid to the development of a breed of horses which shall be valuable for its general qualities of utility.

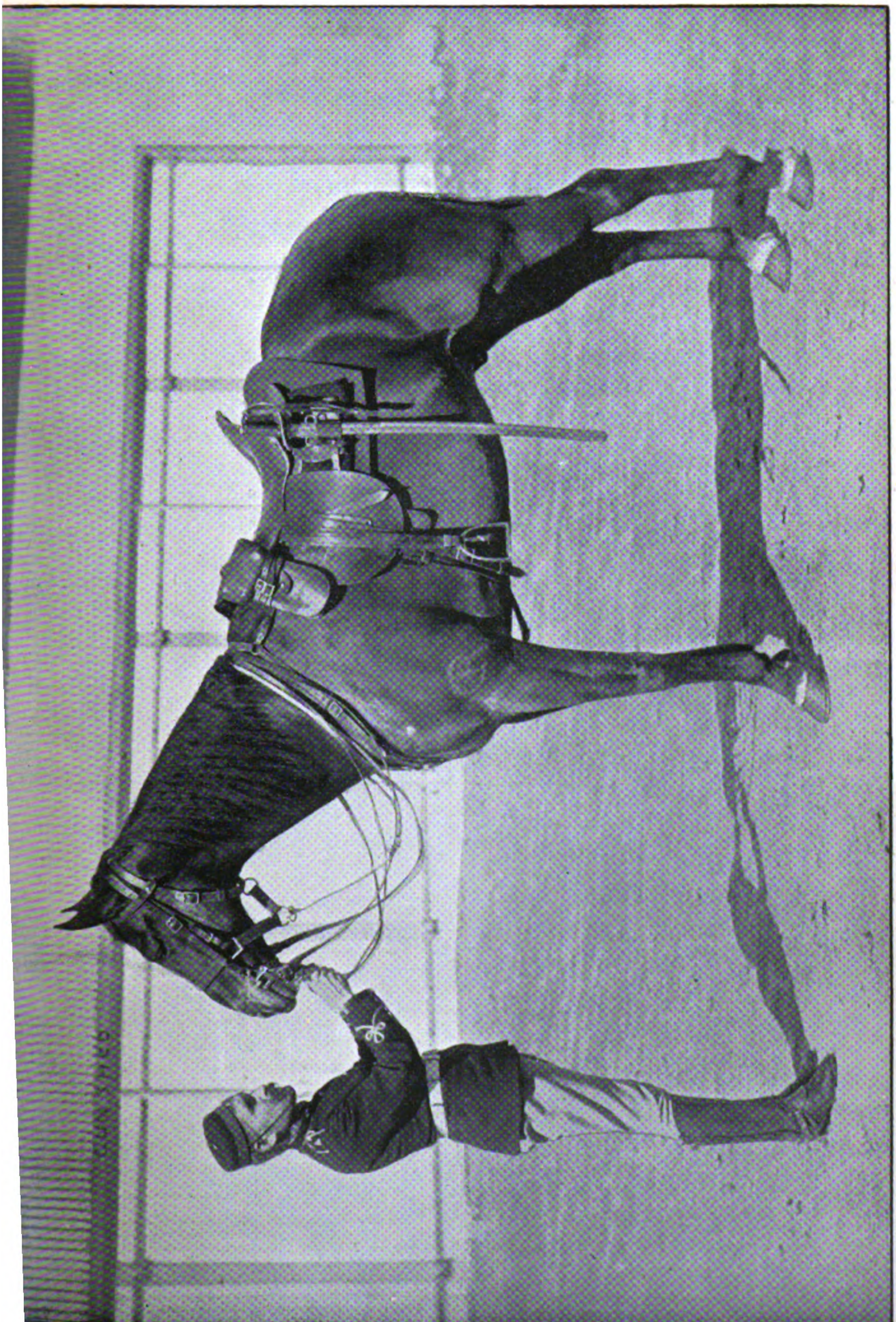
It is, further, a matter which deserves earnest thought as to whether the capabilities of soil, of climate, and economic facilities possessed by Australia to breed horses have not been overlooked, and whether a great trade in horses, especially for military purposes, might not be developed in Europe with the most important results to the whole of Australia and to New South Wales in particular.

There are four descriptions of horses required for military purposes, namely:—

1. The heavy cavalry horse, of bone, quality, and power, 16 hands.
3. The light cavalry horse, of good body and good quality, 15-2 hands.
3. The artillery horse, of power and activity, 15-2 to 16 hands.
4. The transport horse, of bone and power, 15-2 hands.

The medium class, or light cavalry horse, may be estimated as representing to a European Military Power, £75 as a five-year-old, or, at the commencement of its military life. It may be calculated that 30,797 horses of all kinds are yearly required by the armies of Great Britain, France, Germany, and Austria, namely:—France, 14,100; Germany, 9,370; Austria, 5,840; Great Britain (exclusive of India), 1,470. This enormous number is with extreme difficulty supplied in times of peace—with the strain of war the demand for horses would be prodigious.

The importance of developing a trade in horses, now in times of peace, with the prospect of increased demand in time of war, I leave to some abler pen than mine to show. I have only endeavoured to indicate the possibilities of a source of wealth which my experience in remount questions in other parts of the world have put me in a position to realise.



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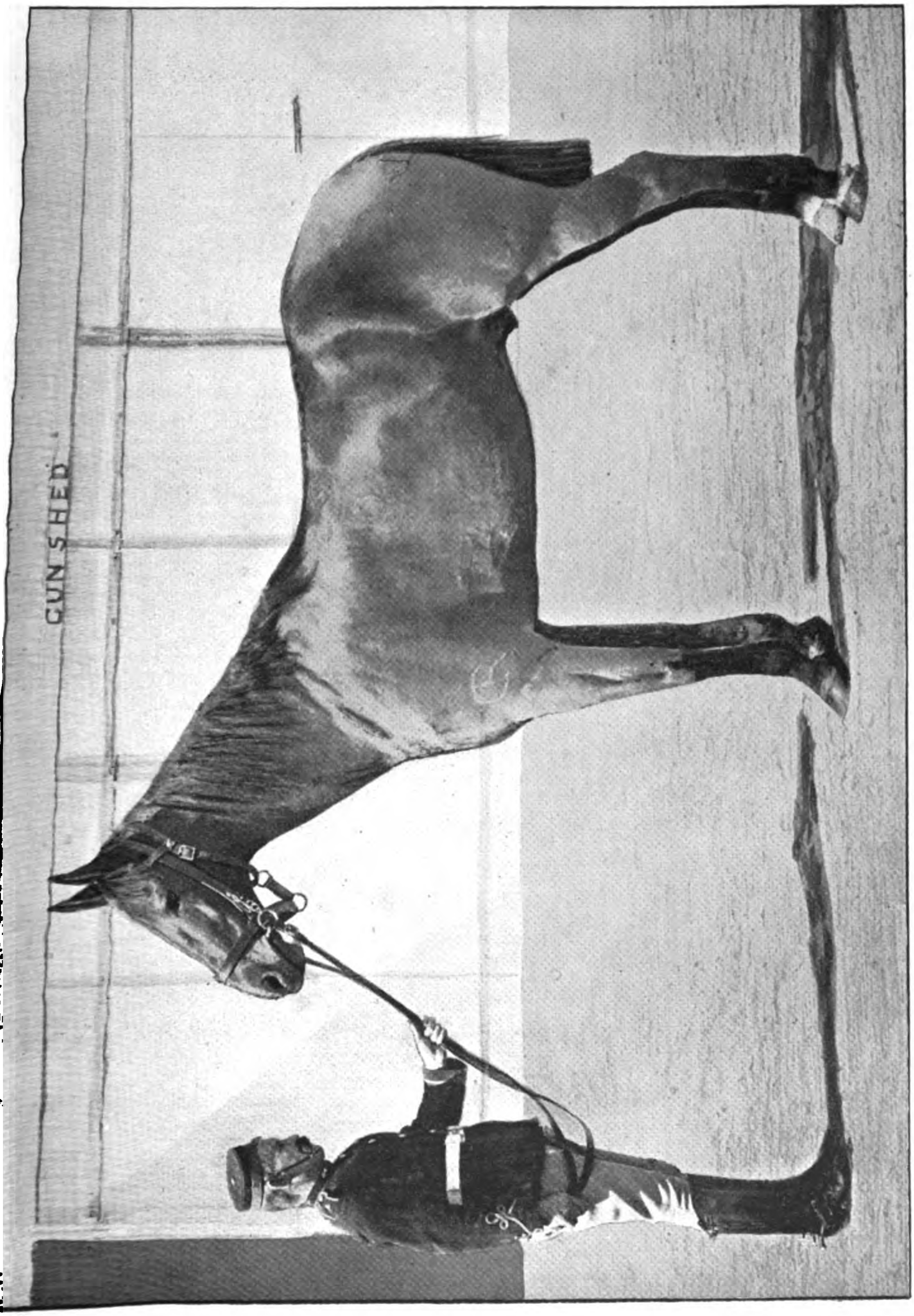

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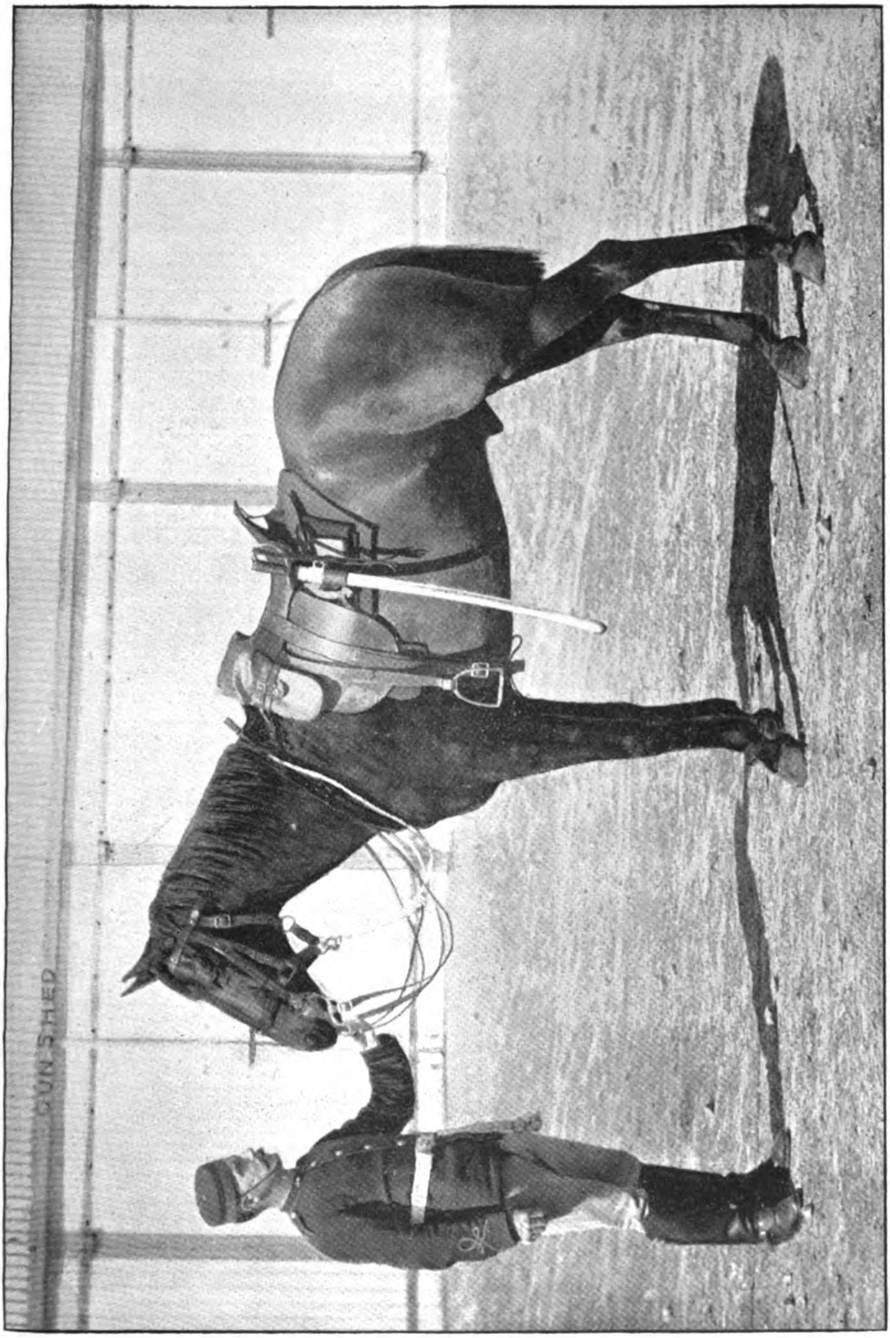

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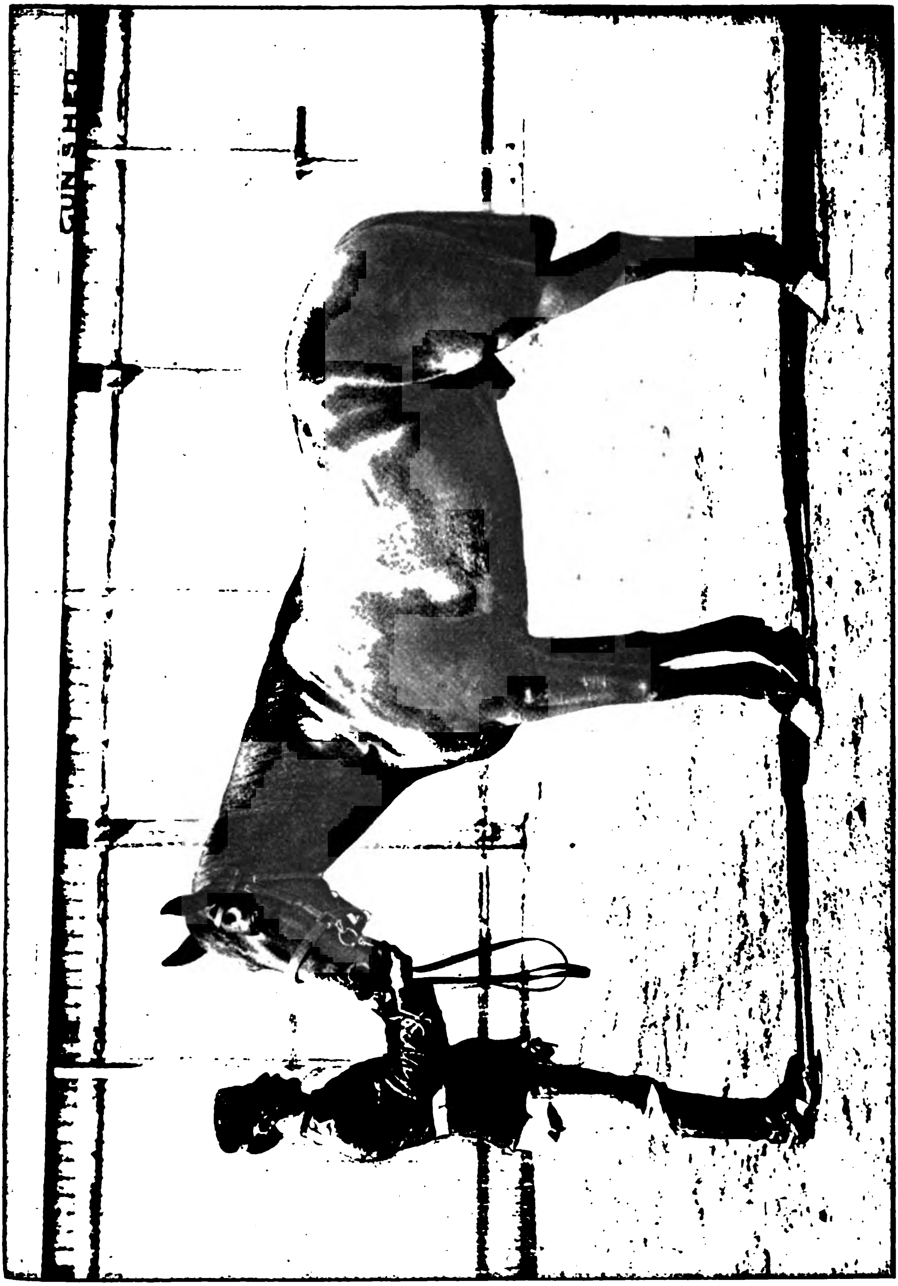

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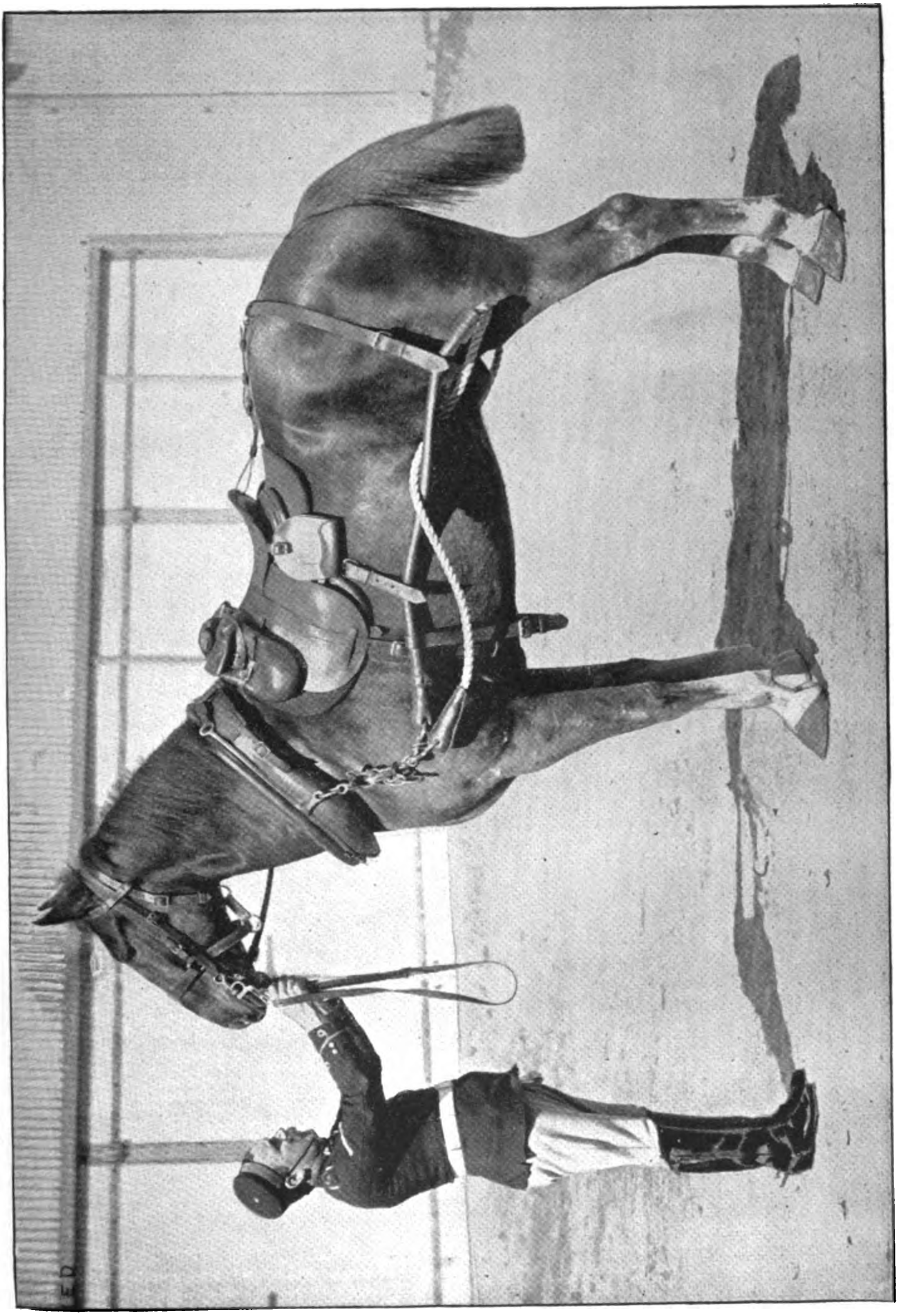
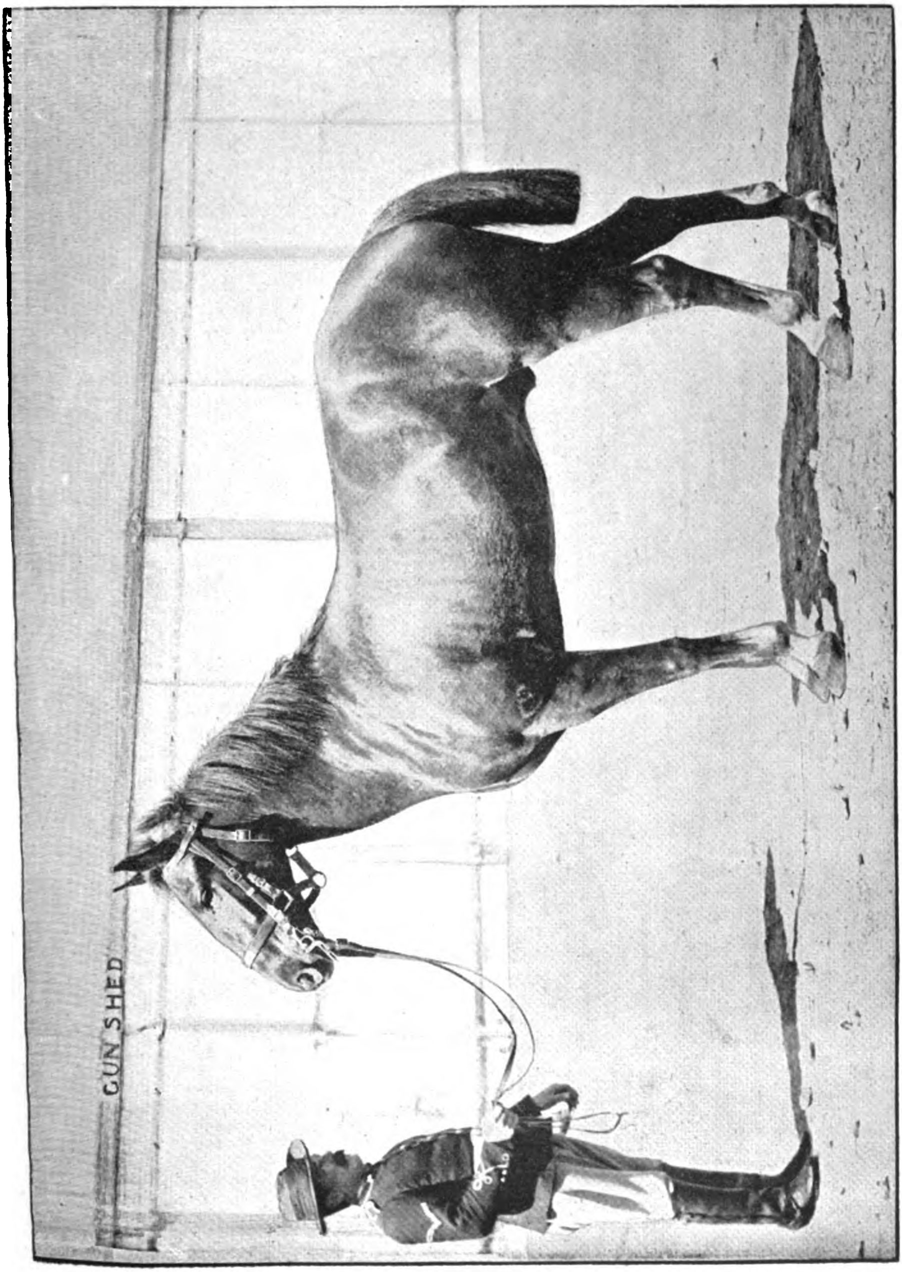


ARTILLERY HORSE.



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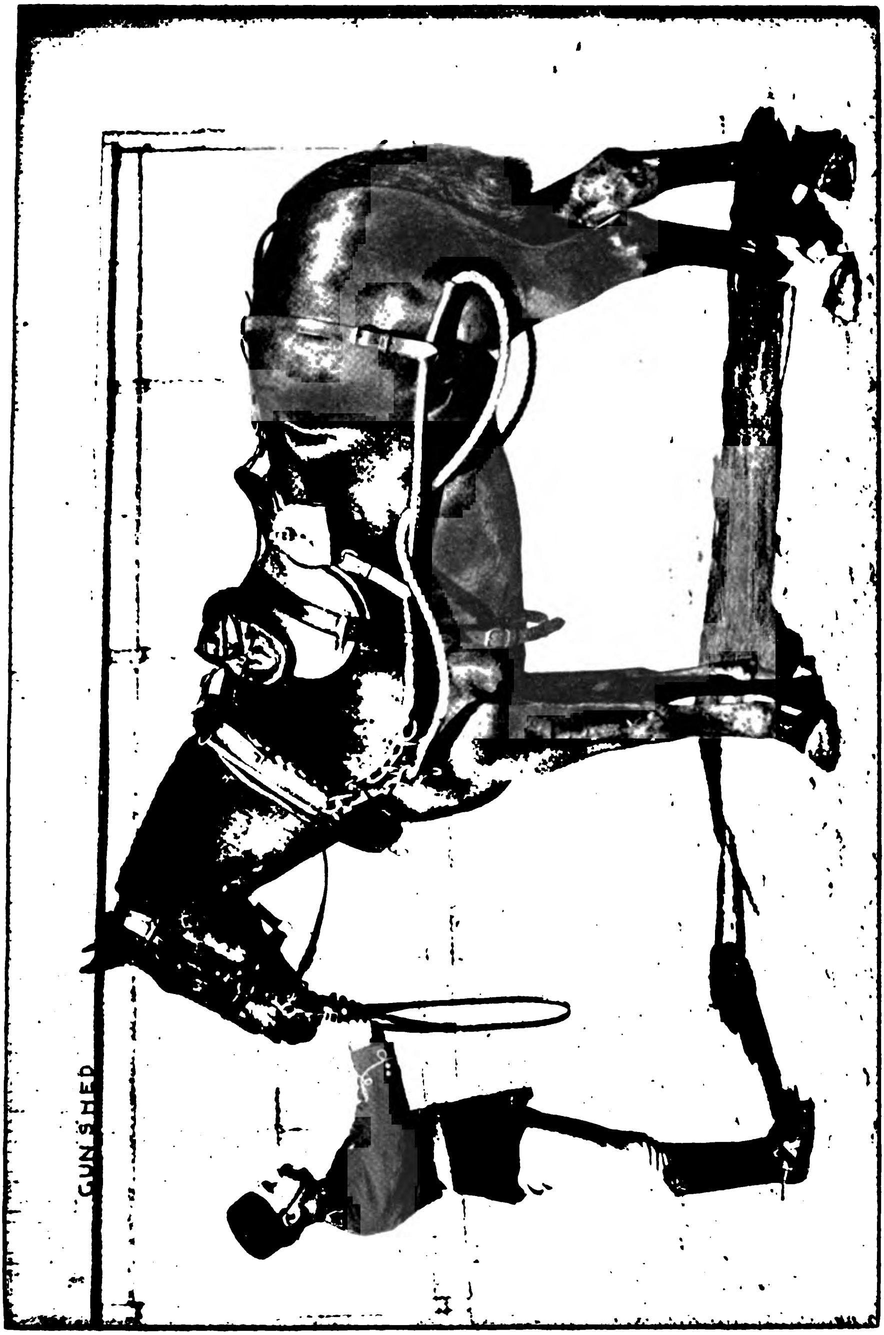
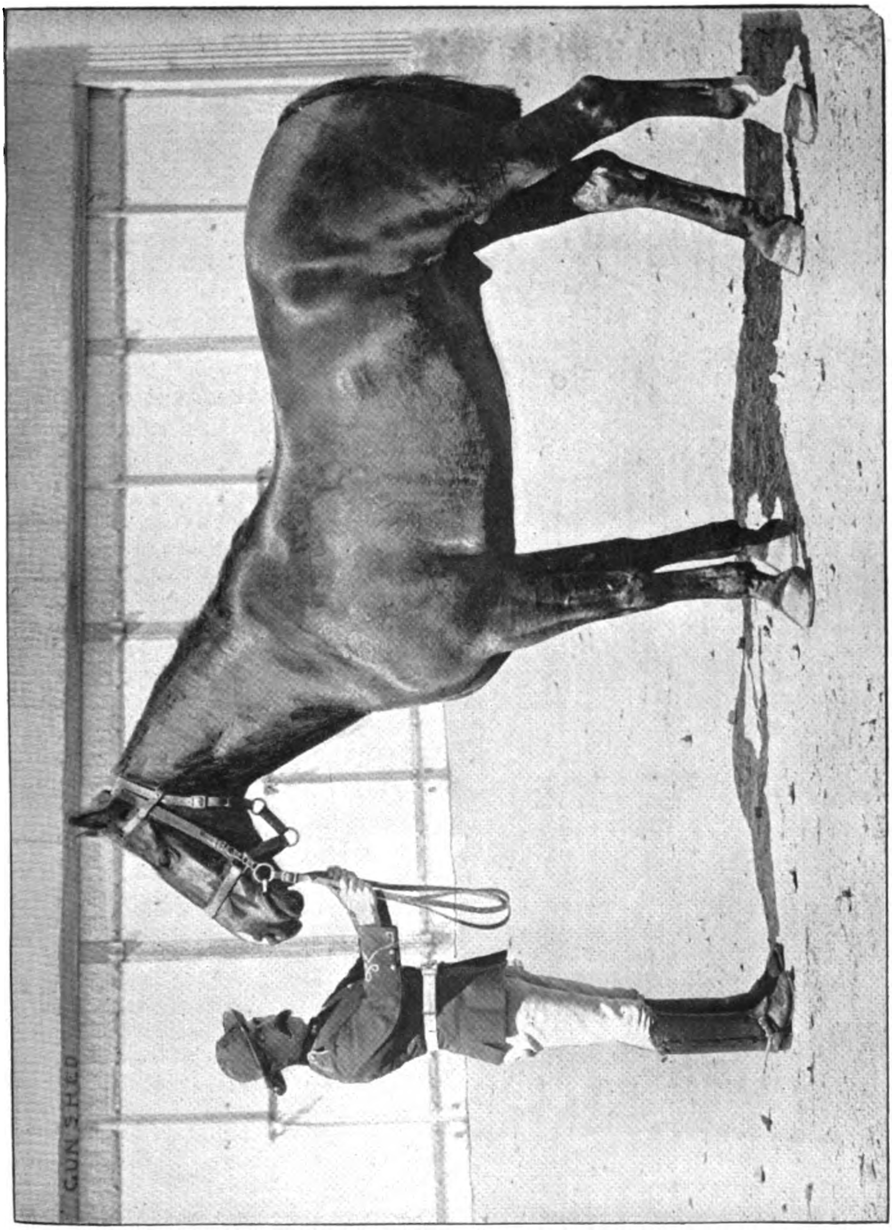


TRANSPORT.



TRANSPORT.

Horses for Indian and European Markets.

By J. L. THOMPSON,
Principal, Hawkesbury Agricultural College, Richmond.

IN these days of depression and low prices for almost every product, the capabilities of our soil and climate for producing a horse suitable for the Indian and European trade commends itself to all who have the interests of this great continent of Australia at heart.

Australia is already famed for its wool, beef, mutton, dairy, wine, and other products; and the conditions of its food and climate are more favourable to the production of a serviceable horse, particularly for the great continent of Europe and India, than perhaps are those of any country in the world. Here, as a rule, we have no severe winters, and horses can be produced on the natural pastures with little or no artificial feeding. Australia is pre-eminently a most desirable place for cavalry horse breeding, as is manifest from the fact that the Government of India require a large annual supply of horses of a sort which it has been well ascertained can neither be bred in India, nor purchased at any place nearer to it than Australia. The breeding of heavy draughts of the Clydesdale, Shire, Suffolk Punch, and other kindred classes is not by any means remunerative at the present time, and the high prices of twenty years ago which then obtained for this class of horse has gone, I fear never to return; whereas, a first-class light-legged horse, with breeding and quality, always commands a high price, either for saddle or carriage purposes.

The iron horse, swift steamers on our rivers and seas in the intercolonial trade, have to a great extent superseded the services of the draught horse.

Horse-breeding for the turf is a very precarious undertaking, and only those of independent means can continue to prosecute this business.

I have in my mind the case of a noted stud-owner in this Colony who sold a yearling filly for £1,400 in 1892, while in 1893 some twenty head of yearlings of the same breeding only realised about the price of the one filly of the previous year.

The breeding of suitable horses for the Indian and European trade can be undertaken by the occupiers of small and medium-sized farms, and I know of no investment that would pay better, or be more easily and pleasantly undertaken. Moreover, the mares required to produce suitable horses for export, when mated to the proper sire, could perform the whole of the work of a mixed farm, and at the same time rear a valuable foal each year. It is well known that a mare can be worked with care almost up to the day she foals, and be all the better for it.

Another advantage the small holder would have is that the youngsters, being accustomed to the stable, harness, drays, &c., while suckling its dam it would be much more docile than the animal reared on a large run.

As the Indian remount service prefer their horses unbroken, very little handling would be necessary, as the youngster thus bred could be taught to lead with a few lessons. It could also be shipped with greater safety, and would, I am sure, have a better chance of standing the sea voyage, and arriving at its destination in good condition without knocking itself about. A little chaff and corn could also be given to the young stock during the winter months, or periods of drought, and at the present prices for farm produce I do not consider the feed could be put to better account. Another advantage the small holder would have would be that he could obtain a better selection of sires, and could mate his mares with those which would be most likely to produce the most suitable animal. It would certainly be a very valuable adjunct to the farmer if only, say, five or six head, worth £30 each, at 5 years old, could be added to his income. Taking into consideration the low price of wool, cattle, and produce generally, I know of nothing that would pay better at the present time.

Colonel Williams, of the Indian remount service, paid a visit to these colonies some few years ago in order to ascertain how far the breeders here could supply the demand for the Indian service; and after visiting several of the studs in Australia he expressed himself as simply astounded at the capabilities of the herbage, climate, and economic conditions for producing the class of horse wanted in India. It is now generally admitted by Anglo-Indians and dwellers in the Mauritius that the soundest and most durable horses for a hot climate are those bred in Australia. The class of horse in greatest demand in India for remounts, Colonel Williams says, is a stout animal between 15·2 and 16 hands high, with as much breeding as possible. The British soldier and his accoutrements weigh from 16 to 18 stone, and a weak weedy animal is simply useless. For a suitable horse the Government are prepared to pay £46 sterling for a five-year-old learned to lead only. It costs £11 sterling per head to land a horse in Calcutta, thus leaving £35 sterling for the breeder. This animal would represent the medium class of cavalry horse mentioned by Major-General Hutton as being worth, to a European military power £75 sterling as a five-year old, or at the commencement of its military life. Now, the question may be fairly asked, with the material at present in these Colonies, how are the four descriptions of horses required for military purposes, as mentioned by the Major-General, to be produced? After consultation with some of the most experienced horse-breeders in this Colony, I am of opinion that the first and second descriptions might be produced from the same source, as they will, no doubt, vary in size and quality.

1. The heavy cavalry horse of bone, quality, and power, standing 16 hands high.
2. The light cavalry horse, of good body, and good quality, standing 15·2.

I think it will be recognised that there are fewer of the above classes of horses in Australia at the present time than there were twenty years ago. It is unfortunately too true, as the Major-General says, that owing to insufficient attention being paid to the breeding of horses for domestic purposes, they are gradually deteriorating. It cannot, therefore, be expected that large numbers of suitable horses can be produced for some time to come; still the sooner breeders commence operations on the proper lines the better it will be for all concerned.

Now as to the production of the above:—1st, the heavy cavalry horse of bone, quality, and power, and the light cavalry horse of good body and

quality, standing from 15·2 to 16 hands in height, as already mentioned, in my opinion, can be produced from one common source, as they will, of course, vary in size and quality as already indicated.

The Selection of the Dam.

There is at the present time in this Colony, in my opinion, a large number of clean-legged, medium sized, handsome mares with good bone and heads, good action and tempers, and standing from 15 to 15·2 hands high. They should have as much breeding as possible, good constitutions, and capacity for work. Greys must be discarded, as they are not in favour for army purposes. No doubt most of the above would prove, on inquiry, to be the product of a thoroughbred stallion from a clean-legged draught mare.

The Selection of the Sire.

It is well known that the Arab sire has given the best results in India but they cannot be obtained here in sufficient numbers. The English thoroughbred has not been successful in India in getting the class of stock required, as many of their produce are spindle-shanked and light-barrelled. The Norfolk trotter, Yorkshire roadster or hackney (synonymous terms), in my opinion, mated with mares as described above, will get the stamp of horse required. Some, no doubt on the true principle of breeding, will object to this horse as a sire, being generally supposed to be a half-breed; but these horses have become, from steadily pursued breeding for many generations, a distinct class and stamp, and can, as a rule, be depended upon in getting stock after their own characteristics.

Even in India it is authoritatively stated that these horses get better limbed and generally more powerful stock than any of the other breeds, and are now being largely used by the Indian Government. A leading authority in England says of the hackney stallion: he stands on stout short legs, with excellent feet and joints, and is sounder perhaps than any other breed in England. After all, the best English thoroughbred blood predominates in the veins of the modern hackney. The hackneys are coming to the front, and they will stay there.

Mares of the description given, put to such horses as Mr. Philip Charley's of Belmont Park (Lord Derby, junior), cannot fail to produce stock suitable for cavalry horses for India or any European nation. Of course it will never be expected that every animal so bred will be fit for cavalry purposes, but the great majority I feel assured will.

I am strongly of opinion that to produce artillery and transport horses, of bone, power, and activity, the Cleveland or Yorkshire coach-horse must play an important part. I have had considerable experience with half-bred Clevelands for active farm work, in Victoria, and I have never seen horses that could do more work with so much ease, and upon so small a quantity of food. They may truly be termed a general-purpose horse, being all that could be desired for active farm work in the field—active and powerful on the road, or, if need be, the saddle. They are also good-tempered, docile, with good constitutions.

If selected active, powerful, staunch, sound, medium-sized draught mares are put to a first-class Cleveland Bay or Yorkshire stallion, a great majority of the progeny will be fit for artillery or transport purposes, as some will be necessarily bigger than others.

Horse-breeding in India.

I have before me notes by the late Mr. E. M. Curr, Chief Inspector of Stock, Victoria, on a report by J. H. B. Hallen, General Superintendent of horse-breeding operations in India, dated Meerut, 9th March, 1886, from which I transcribe the following pertinent remarks:—The Government of India have given up horse-breeding entirely, after over eighty years unsuccessful trial, but they continue to import stallions, whose services it supplies gratis to the best mares of country breeders. Some 300 stallions are kept by the Government for this purpose. It is shown by the report that India is highly unsuited to the breeding of horses by the following recorded facts:—

1. That it is found necessary to allow an imported stallion a considerable period in which to become acclimatised before he is put to the stud.
2. That the average number of foals got by a stallion in India amounts only to something over twelve, instead of to sixty or one hundred, as in Australia and other countries.
3. That the produce of imported stallions displays, when compared with their sires, a great falling of in bone below the knee, and general want of substance.
4. That mares imported into India are constantly twelve or eighteen months before they are capable of breeding.
5. Again the cost is very great. Colonel Robbins, who some years ago was purchasing horses in these Colonies for the Indian Cavalry, stated that no stud-bred horse in India was ever delivered fit for use under £100.

The first thing noticeable, then, in horses of both sexes introduced in India, is, that there ensues at once an attack on and permanent reduction of the sexual or procreative powers. A fact so well known and important should require no comment. It accounts for all that follows in India. What then is the cause of these results? What is it that has wrecked in India the attempt so long and urgently made to breed troop-horses of substance, stamina, and good legs?

There can be no doubt that it is the unsuitability of the climate which affects not only horses alone but extends also to the human race, dogs, and other animals in India. That horses in India have been somewhat improved by selection and the use of picked sires must be granted, but the proceeding is a costly one, and the climate is always undoing what man has temporarily improved. In the words of Mr. Curr, the production of good horses in India is an impossibility—as well try to grow grapes in Greenland. In support of this statement it must be remembered that the most vigorously constituted and longest lived saddle horses are found in dry climates, as the Arab, the Barb, and the Persian; and that the horses of moist climates, especially if hot, are ever of poor quality. Taking these facts into consideration, it will be admitted that the Australian breeder of horses may safely conclude that the production of horses for army purposes in India must eventually fall to him; and it is certainly good news to the Australian horse breeder to hear, from so high an authority as Major-General Hutton, that nearly all the European military powers are in want of cavalry, artillery, and transport horses. These, to the number of 30,797 head per annum, at the handsome figure mentioned by the Major-General, of £75 sterling per head amounts to the enormous sum of £2,309,775 sterling.

Surely this is the best news that the Australian farmer has heard for some time. Considering the great importance of the subject, not only to the occupier of the lands of this Colony but to the entire community, I would strongly commend to the notice of the Hon. the Minister for Mines and Agriculture the desirableness of calling together the leading horse breeders in this Colony in conference to discuss this important subject. I am satisfied that this course would be productive of great good. The director of army remount operations for India, in the report submitted by him after his return to India from Australia, mentions that in certain districts in Australia thoroughbred stock with large bone, and promising in every respect as sires for Indian horse breeding, were obtainable. In reply to circulars sent to the leading breeders in this Colony by the Indian Government, the following is the reply from W. J. Dangar, Esq., Neotsfield, Singleton:—"I shall have much pleasure in doing what I can for you in informing the breeders of your requirements. I must, however, say at the outset that there are very few breeders who breed the description of horse you require, and who would care to export them for the money, viz., 2,500 rupees each. We are in quest of the same kind of horse ourselves. The stallions mostly used are those that have been on the turf. The good ones fit to breed from are worth £500 to £1,000, and those which might be got at your figure would not be the sort you require, nor indeed would it be judicious to breed from them, being mostly light in the leg without substance. Your best place to get horses at all would be to get them here. No one would send horses to Calcutta to be approved of on inspection by yourself or deputy, especially, as I said before, as they can get more here for such stallions as you describe, and which are very hard to obtain."

With a view to ascertaining the extent of the trade carried on between India and Australia in horses, I placed myself in communication with the chief inspectors of stock of the four principal Colonies—New South Wales, Victoria, South Australia, and Queensland with following results, for which I tender my sincere thanks for their prompt and courteous replies. Total numbers and values of horses exported to India during the several years indicated:—

		£
	New South Wales.	
1889	190 horses, value	1,900
1890	861 " "	11,581
1891	440 " "	8,800
1892	865 " "	19,490
1893	213 " "	5,320
	Victoria.	£
1889 to 1893	16,800 horses, value...	402,500
	South Australia.	
1889	nil	nil
1890 to 1893	966 horses, value	19,320
	Queensland.	
1889	nil	nil
1890	257 horses, value	2,570
1891	nil	nil
1892	240 horses, value	1,542
1893	961 " "	9,380

It will be thus seen that during the past five years no less than 21,793 horses have been exported from the above Australian ports, representing a total money value of £482,403 sterling, or an average of a fraction over £22 2s. 8d. per head.

As the majority of these horses have been purchased by dealers from as low a price as £7 per head, and a decent horse fit for the Indian remount service is worth in Calcutta not less than from £46 to £53, it will be easily seen that the middleman secures the lion's share of the profit to the detriment of the breeder.

This calls for some reform in the manner of disposing of horses for India, and until this has been accomplished the Australian breeder will not reap the full benefit of this highly remunerative enterprise.

The extortionate charges of the middlemen is a serious drawback to the advancement of the producer at the present time all over the world.

The middlemen have been termed a "numerous and formidable class of social parasites," and are graphically described in a little volume entitled "Colonial Couplets," published by Simpson and Williams, Christchurch, New Zealand, from which I extract the following:—

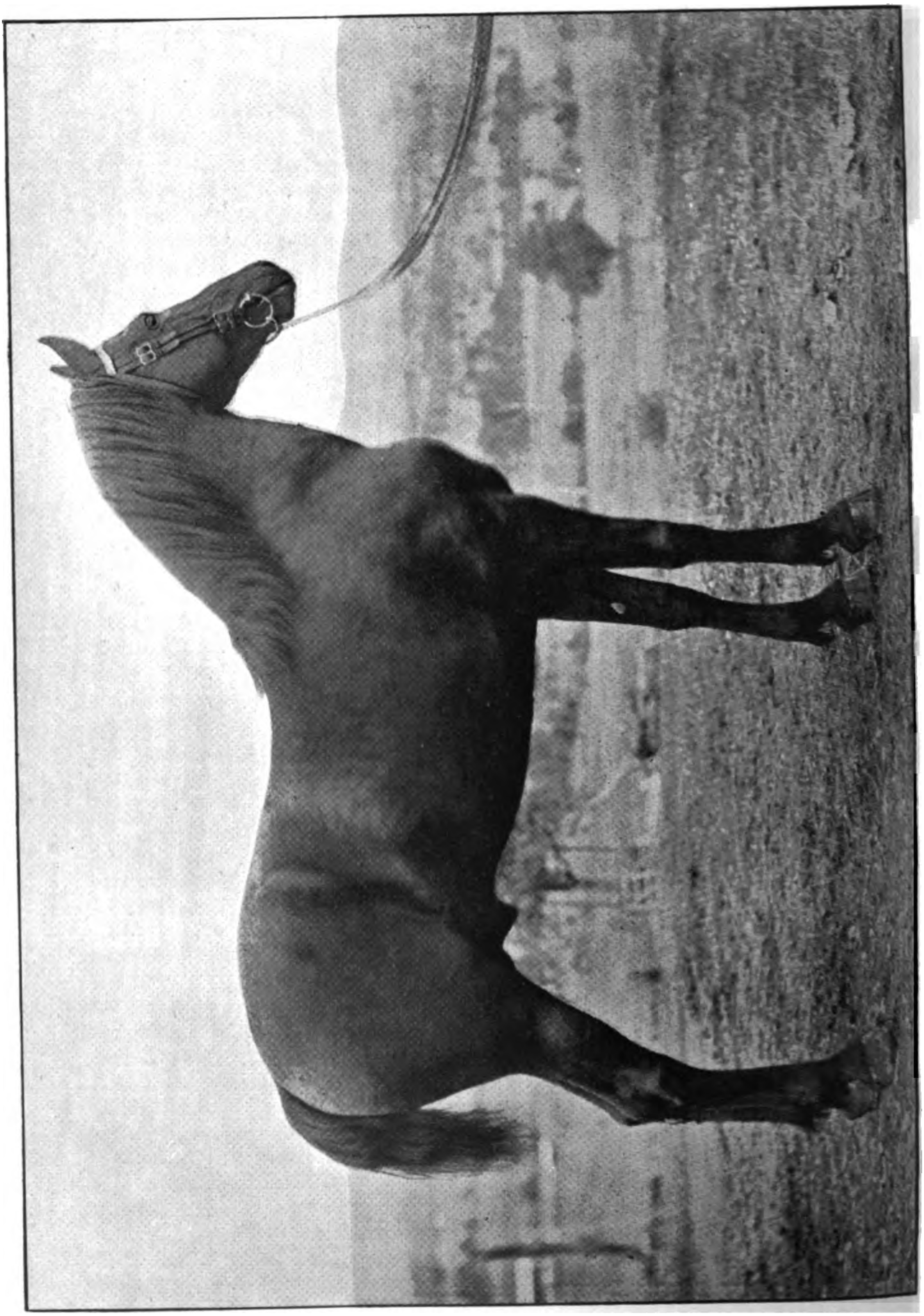
There's a man who plays a paying game,
  Whatever he may say,
Whose name is a great and mighty name
  Over the world to-day;
Who stands at ease where others fall,
  Where others sink can swim;
While those who toil and spin—yes, all—
  Work, sweat, live, die for him:
He's an absolute ruler, deny it who can,
  Our modern monarch, King Middleman.

* * * * * *

There's a trick to swell each big account,
  And every little bill,
Each item in the grand amount
  Insensibly to fill;
For they charge to buy and then to sell,
  They charge for charging, too,
And then charge you for me as well,
  Then me for charging you.
'Tis a marvellous science, deny it who can,
  The double game of the Middleman.

Endurance of the Australian Horse.

Of the endurance, staying power, or what is termed bottom, of the Australian horse many instances can be given. In 1873, I rode, with a weight of 13 stone, a half-bred Cleveland 95 miles in one day, between the hours of 6 o'clock a.m. and 10 o'clock p.m. with only two breaks of three quarters of an hour each. Mr. Galvayne, the Australian horse-trainer, mentions having ridden a mare 168 miles in two days; and a Mr. Archie Ferguson, of Wallon, on the Dawson River, Queensland, rode a little horse named "Billy Button" 70 miles between midnight and daylight of the following morning. A Mr. T. S. Collins of Eton Vale, Queensland, rode a horse named "Bonnie Doon" 104 miles between the hours of 8 a.m. and sundown. A Mr. P. Bolger, on a horse named "Boomerang," near Rockhampton, rode 105 miles between sunrise and sunset. A doctor at Mudgee drove a pair of ponies 120 miles to see a patient within one day. A Mr. Evans, who rides 17 stone, rode in one day from a station near Hillston to Hay, a distance of 111 miles. A Mr. Henry, who resides near Swanhill, has a station 110 miles distant, and he frequently drives this distance with half-bred Clevelands of his own breeding on the one day, returning the next; making a journey of 222 miles in two consecutive days. None of the horses above referred to suffered in the slightest degree from the effects of these long and tedious journeys. When one considers the rough treatment that horses receive,



Mr. Charley's Hackney Stallion, "Lord Derby, Jun." (16 hands high).

travelling day after day a long overland journey from dawn to dark, many nights with no greater refreshment than a whack on the rump with the bridle, as they are turned out to grass on land many times as bare as your hand, it is simply marvellous the endurance of many of the Australian horses.

Tax on Stallions.

I quite concur with the remarks of the Major-General that it would be in the interests of all concerned if a tax were imposed on all stallions in this Colony. This, however, would have to receive the support and concurrence of each of the other Colonies to render it effective—it would require to be, in effect, a federal law.

The Colony of Queensland has taken the initiative with regard to this matter, and the press of that Colony is teeming with letters on the subject dealing with its *pros* and *cons*. Some of the writers aver that the imposition of this tax interferes with the liberty of the subject; while others, notably Mr. A. T. Ball, of Varoville, Mackay, takes quite an opposite view of the matter.

A tax of, say, £20 per head on stallions would restrict the breeding from weakly, useless sires; and owners of first-class stallions would be only too pleased to pay the tax, as it would relieve them from having to enter into competition with the owners of inferior animals.

This question was mooted in South Australia some years ago, and I am satisfied it only requires concentrated action on the part of the Colonies to bring this tax into law. It would, however, I feel satisfied, be useless for either one of the Colonies to introduce such a tax without the support of the others in their too adopting a similar measure.

Chemical Notes.

By F. B. GUTHRIE.
Departmental Chemist.

Sea-weed as a Manure.

Sea-weed is not at a first glance a very promising fertilizing material. It has, when fresh, a fertilizing value somewhat lower than that of farmyard manure, and its large content of water prevents its carriage in a fresh state to any distance with economy. Even at the distance of a few miles from the coast the cost and labour of transport places it out of court as a fertilizer. Its use is therefore limited to farms situated immediately upon an accessible coast; but in such cases there is no doubt that it might be applied with advantage more frequently than at present.

In the coastal districts of Great Britain, especially Scotland and Ireland, France, Norway, and the United States, sea-weed is largely used as manure. The general custom is to fork it straight into the land like dung, and this is the best method for such sea-weeds as decompose rapidly and can be easily distributed, such as the different varieties of kelp, and ribbon-weed. These may be strewn over the land or ploughed lightly in, and rapidly decompose and disappear. For the tougher kinds, such as eel-grass, it is usually recommended to compost with lime. This is done by building a stack of alternate layers of sea-weed and lime, the layers of sea-weed being about 6 inches deep, and covered with lime. The whole stack may be conveniently covered with gypsum to prevent loss of ammonia. The heap is left for two or three months, and then turned over at intervals until well rotted. It is doubtful whether composting is economical in the case of the more readily decomposed varieties above mentioned.

Though a poor manure, it is fairly rich in nitrogen and potash, its weak point being its phosphoric acid. For this reason a previous dressing of the soil with bone-dust is stated to be beneficial. Its use must be avoided on certain crops, such as beetroot and tobacco, which are injuriously affected by chlorides, which are present in sea-weed in considerable quantities in the form of common salt. For the same reason, plants such as asparagus, and small fruit, such as raspberries, which require much saline matter, are benefited by its use. Potatoes are said to contain less starch when manured with sea-weed, and to acquire in consequence a somewhat soapy taste; at the same time, in many parts of the coast of Ireland, sea-weed is almost the only manure used by the peasant for his potato crop.

It must be carefully spread, especially if used as a top-dressing for meadows, as it is otherwise liable to destroy the grass when used in large quantities.

Storer (Agriculture) points out that it is entirely free from seeds of weeds, spores of fungi, and eggs of insects, consequently it is a comparatively easy matter to keep the farm clean.

The ash of sea-weed contains a considerable quantity of fertilizing materials, potash and phosphoric acid, and in some cases it may be found economical to utilise seaweed in this form. The nitrogenous matter is, of course, thereby lost. The ash is richer in fertilizing substances than wood ashes—the potash varies in the different varieties from 4 to 20 per cent.

Except for the larger amount of water contained in it, sea-weed compares favourably with farmyard manure.

The average composition of cow-manure is roughly:—

Water	77·0 per cent.
Nitrogen	·5 "
Potash	·6 "
Phosphoric acid	·15 "

The following table shows the composition of the most abundant species of sea-weeds, determined by Messrs. Wheeler and Hartwell, of the Rhode Island Experimental Station, who have also collected a large amount of valuable information as to the use of these plants:—

	Water.	Nitrogen.	Potash.	Phosphoric Acid.
Ribbon-weed, Kelp, Tangle, *Laminaria saccharina*	87·99	·17	·16	·05
Broad-ribbon weed, Broad-leafed Kelp, Devil's apron, Tangle, *Laminaria digitata*	87·50	·23	·31	·06
Dulse, Dillisk, *Rhodymenia palmata* ...	86·25	·37	1·07	·09
Round-stalked rock-weed, *Ascophyllum* (*Fucus*) *nodosum*	77·26	·24	·64	·08
Flat-stalked rock-weed, *Fucus vesiculosus*	76·35	·38	·65	12
Irish or Carragheen Moss, *Chondrus crispus*	76·03	·57	1·02	·13
Eel-grass, grass-wrack, *Zostera marina*	81·19	·35	·32	·07

Sulphate of Ammonia and Nitrate of Potash in Potato-growing.

In connection with the question of the efficacy of a "soak" composed of the above ingredients in promoting the growth of potatoes, to which attention was drawn in the *Gazette* last year, the following gentlemen have communicated their results:—

Mr. Stinson, Armidale, 23rd October of last year, soaked a bag of Brownell's seed, part whole and part cut, in a mixture of 3 lb. sulphate of ammonia and 3 lb. nitrate of potash dissolved in 12 gallons water, for twenty-one hours. Also a bag of Black Derwents (splendid seed), almost wholly cut, for the same time. A second bag of Brownell's seed was left in soak only twelve hours. All were turned out to dry for forty-eight hours and ploughed in. All the seed were well budded before soaking, and on removal from the bath all the buds were pinched and blackened; the second lot of Brownell's (soaked twelve hours) being much less affected.

"Of those soaked twenty-one hours about one-tenth grew, and some of them took six weeks to come up, and were the most delicate potato plants I ever saw. Those soaked twelve hours came up in about three to four weeks, about one-tenth having missed. They were well attended to afterwards, and were dug—those soaked twelve hours about middle of March, and those soaked twenty-one hours three or four weeks later. The crop being so scattered I made no attempt to ascertain the weight. Those of twelve hours' bath made the fastest growth from start to finish, and gave a fair crop considering the light soil. The others gave a much heavier crop per plant, the weight from some plants being 9 lb., and the largest tubers, of which I could have picked a few score, were over 2 lb." Mr. Stinson points out that though he departed from the directions in cutting the seed, they were well dried after cutting.

"The conclusion I arrived at was that the solution was too strong, yet that there is virtue in it is evident, as witness the result; those bathed twenty-one hours beating those of twelve hours."

The soil in which the above experiments were conducted was "a whitish soil with ironstone bottom, at a depth of 9 to 18 inches, and running down on to a black soil with stiff clay bottom. The land was well cultivated, but not manured."

Mr. Thomas Waldron, Hartley Vale, writes as follows:—"Last spring I treated 1 cwt. Early Rose and 4 cwt. Brownell's Beauty by immersing them in the above solution (copied from *Gazette*). I cut a few of the sets; those that I cut became blackened, and rotted in the ground. The whole sets came up very strong indeed, and were admired by all who saw them. The effect produced by the treatment being a gain of, at least, 15 or 20 per cent. over those not treated with the solution, those treated being all of a large uniform size with scarcely any small ones whatever, but it did not seem to prevent disease attacking them. The soil was a gritty loam, a portion being a red sandy loam. Farmyard dung was used liberally."

Mr. J. H. Bennett, Castle Hill, writes that he has tried the soak in question, with the same results obtained by Mr. Gray, and published in the July *Gazette*. "The seed, however, was the Early Rose, Manhattan, and a few Circular Heads. These latter, being in sloping ground, did better than the former, which were on level ground. The seed not soaked yielded much the larger number of potatoes to the hill, came up earlier, and with not nearly so many misses. The soil is a fairly heavy loam. The apparent cause of failure appears due to the wet weather causing the sets to rot. We dug those sets that came to anything at all in June, and got about three parts the quantity of seed sown."

The above experiments are exceedingly interesting and instructive. There appears to be no doubt that the method of treatment in a modified form will be found to increase the yield. The point we have to get at is what modification does it require to suit our varieties of seed and our different conditions. If by any means we can ensure anything like the increase reported in France, surely a little extra trouble and expense, taken in order to definitely fix the exact conditions necessary for success, will be a small matter. I trust that all those interested in the matter will take it up in the coming season. If everyone would set apart a small corner of his coming crop for such an experiment the results thus obtained from a number of individuals working independently will be simply invaluable, and will go far (if not the whole way) towards the solution of the question.

For the benefit of those who care to take the matter up, and in order that all results should be comparable, I venture to suggest the following

plan on which the experiments should be conducted. The following points should be particularly attended to:—

1. Untreated sets should be grown at the same time as the treated ones, for purposes of comparison.
2. Treated and untreated sets should be grown under exactly the same conditions, such as the previous preparation of the soil, manuring, hoeing, &c.
3. The land should be parcelled out into measured patches, if possible some fraction of an acre.
4. Definite weights should be taken, say 1 cwt., or ½ cwt., or ¼ cwt., both of treated and untreated.
5. The harvest must be weighed in all cases, the treated and the untreated separately.
6. The dates should also be noted of germination and of harvesting, as well as the appearance of the crop at these times.
7. Notes should be taken of the following points:—
   - *a.* Varieties experimented upon.
   - *b.* Nature of soil and its treatment.
   - *c.* Weather during the experiment.

With regard to the experiments themselves, the following appear to me the most important points of comparison:—

One lot should be soaked twenty-four hours and one lot for twelve hours in the full strength recommended. One lot for twenty-four hours and one for twelve hours in half the strength recommended. One lot for twenty-four hours and one for twelve hours in a quarter the strength. This will make six separate patches—a seventh lot should be sown without previous treatment. Thus, if half an acre be set apart for the experiments, it may be divided roughly into seven nearly equal patches, in each of which 1 cwt. of the seed may be sown. Each patch will, therefore, contain the same quantity of seed treated in a different manner.

The following points are also to be noted:—The tubers selected should not be too large and should not be cut before soaking. After soaking, they should be left for another twenty-four hours before sowing.

It would, I think, be better that they should not be too strongly sprouted.

To obtain the best results the land should be thoroughly cultivated and well manured.

If it is inconvenient to follow out the whole of the scheme suggested above, one or two only of the above experiments may be tried instead of the whole six. An untreated lot must always be grown at the same time.

Poisoning of Cattle by Ferns.

The following cutting from the English *Times* deserves attention, from the warning conveyed therein against the improper use of bracken as a fodder for cattle. Bracken is a very valuable substitute for straw as litter in districts where it is abundant. Young ferns, in a dry state, have a considerably higher manurial value than straw, and are probably not greatly inferior as an absorbent.

Analyses of young bracken show—

Nitrogen, 2½ per cent.
Potash, 1¼ per cent.
Phosphoric acid, ½ per cent

It is against its use as a food that the following warning is directed :—

"POISONING OF CATTLE BY FERNS.

"In certain parts of the country, as in and around the New Forest, for example, bracken is largely used as litter or bedding for live stock, particularly cattle or pigs. Large quantities are cut in the autumn, and dried and stacked to be drawn upon as required. Owing to the scarcity of forage last summer, cattle, in some districts were driven to browse upon fern, and coincidently there appeared a disorder which veterinary surgeons were led to regard as a new disease of cattle. The affection bore some resemblance in its symptoms to anthrax, and in several cases it was mistaken for that disease. In not a few instances, however, the suspicion arose that the trouble might be due to the eating of bracken by cattle, though it seemed difficult to believe that poisonous properties in so widely distributed a plant could have been hitherto overlooked. A case reported in the *Journal of Comparative Pathology and Therapeutics* leaves, however, little doubt that the common brake fern, if eaten in considerable quantity, is capable of producing very serious effects upon cattle. A number of animals were first given bracken chopped up with straw, and when they had thus been induced to eat the bracken the straw was gradually withdrawn, until the diet consisted exclusively of bracken and turnips. The result was the death of three of the animals and the serious illness of the others. The *post-mortem* examinations revealed symptoms identical with those exhibited by the animals which had died during the summer, and there is good ground for believing that at least one large herd in which a few cases of fern poisoning occurred last summer was slaughtered in order to prevent the spread of what at the time was believed to be anthrax. It is now made clear that the pothological characteristics of fern poisoning and anthrax are sufficiently distinct as to be readily recognised by the practitioner. The abnormal temperature which is induced is decidedly higher in fern poisoning. On the other hand, the course of the disease is more acute in anthrax, for whereas in natural cases of that disorder the animals are often found dead without having been observed to be ill, or die within a few hours after they are noticed to be ailing, in fern poisoning the animals generally linger for a few days after the onset of the first symptoms. It appears, moreover, that even when cattle, sheep, and horses were being pastured together, cases of fern poisoning were observed in cattle only, though, as is generally known, no such rule holds in connection with outbreaks of anthrax.

We may add that the plant under notice is quite distinct from the male fern, *Lastræa Filix-mas*, the root-stock of which is used officinally as a vermicide. The common brake fern, or bracken, *Pteris aquilina*, to the fronds of which the poisonous effect upon cattle is attributed, grows profusely on poor, sandy soils, and in and around plantations. The bracken is not found growing upon rich pastures."

PINHOE MANURE.

THE following product obtained by a treatment of night-soil, shows the class of manure obtainable from this source. In this case the night-soil has been deodorized with unslacked lime, and thickened with ashes from the burning of house-refuse, after which it is desiccated in a special apparatus.

Moisture	0·92
Organic and volatile matter (containing nitrogen, ·21; ammonia, ·25.)	9·54
Sand and insoluble matter	57·51
Oxides of iron and alumina	4·21
Lime (CaO.)	14·71
Magnesia (MgO)	6·79
Potash (K_2O)	0·56
Phosphoric acid (P_2O_5)	1·26

The product is in an extremely fine state of division and devoid of smell. Though not a very rich fertilizer, (its value according to above analysis being 9s. 6d. per ton), it would be found useful in many cases, such as grass land, &c., and is obtainable at a small cost.

EXPORT OF BONE-DUST.

The accompanying official returns show the quantities of bone-dust exported from Sydney during 1893, and for the first six months of the current year. The returns do not show the full extent of the trade, as shippers do not always take the trouble to pass entries.

They show that Mauritius and New Zealand are far and away the largest importers of our bone-dust.

CUSTOMS RETURNS—Bone-dust exported from Sydney during 1893:—

To	tons	cwt.	To	tons	cwt.
Mauritius	3,961	15	South Australia	179	0
New Zealand	3,683	11	Java	12	0
Victoria	884	9	Germany	6	0
Tasmania	640	15	West Australia	4	10
Queensland	358	0	New Caledonia	3	0
Fiji	390	0			
United Kingdom	39	2		10,331	19
India	219	19			

CUSTOMS RETURNS—Bone-dust exported from Sydney, 1st January, to 30th June, 1894:—

To	tons	cwt.	To	tons	cwt.
Mauritius	1,865	17	Germany	508	0
Fiji	219	4	Victoria	65	0
*New Zealand	1,005	4	Netherlands	29	16
Tasmania	123	17	Sundry places	8	10
Queensland	27	12			
United Kingdom	70	14		3,940	14
South Australia	17	0			

NOTE.—Newcastle shipments do not appear to be included in the above, they should amount to over 2,000 tons.

* New Zealand shipments do not begin in earnest before August and September, and are now in full swing.

NOTE.—Mr. Powell (Collector of Customs) advises that a large quantity of manure is shipped, of which his Department gets no return, shippers neglecting to pass entries.

Poultry.

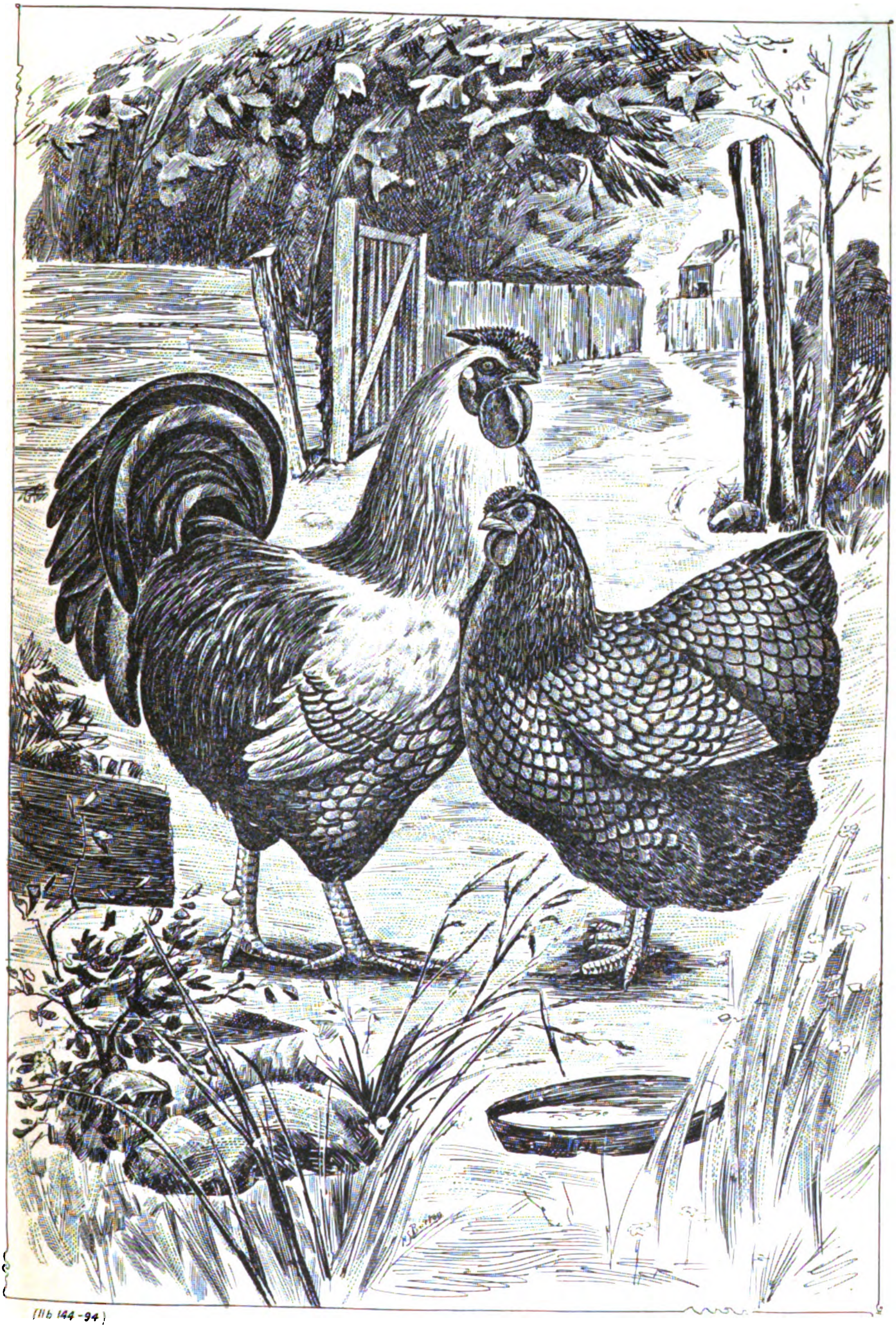
By S. Gray,
Sub-Editor.

Wyandottes.

It was not until visiting the Bathurst district that I had a good opportunity of obtaining some personal experience of this breed. From results given in American and English poultry files I had often wondered at the apparent apathy of New South Wales breeders in regard to the Wyandotte, and now, from personal experience, my wonder is only increased.

The Wyandotte is of American origin, and first appeared in England in 1873 under the name of American Sebright, or Sebright Cochins. There is no doubt that the foundation was an Asiatic breed, and the later specimens are understood to be the result of a cross between Light Brahmas and Polish. The reference in the original name to Sebright doubtless referred to the markings, and these markings on the Bantam of that name were produced from the Polish.

Speaking of the Wyandotte, Lewis Wright says:—"Apart from the plumage, the breed has a decided character different from all others, though some of the points do not seem as yet fully understood by English breeders. Thus, the comb has often been described as that of a Hamburgh; but this is not so. It is a rose-comb, ending in a spike; but it should be much smaller, and specially narrower, than a Hamburgh comb, and the back end and spike should curve downwards parallel to the curve of the top of the head. This comb is as typical of the breed as that of the Brahma. The general shape is nearest that of the Brahma, but with more rotundity and fulness of the breast than usual in that breed, and the whole form very compact, with shortish medium, bright yellow, clean legs. The tail is longer and more full than in modern Brahmas, though some of our original Brahmas possessed as much; it is glossy black and carried flowing, neither squirrel fashion nor low, and the saddle should fill up a handsome curve in both sexes, as in the Langshan; saddle not nearly so full as in other Asiatics. In regard to colour there is one general ideal—as clear as possible white in ground colour, every feather laced as evenly as possible with black, as in a Sebright Bantam. The cock's hackles are white striped with black. The ear-lobes should be bright red, and any white or yellow is deemed a serious fault. Economically, all experience places the Wyandotte very high, at least at present. It has the hardiness of all recently "made" breeds, lays very early and well, feathers and matures quickly, and is a fairly good table fowl. We say "fairly" good, because many people *will* not admire a bird with yellow skin, while this identical yellow skin is in America considered best of all. It has good breast and wings, and not large drumsticks, any way. The hen is



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WYANDOTTES.

a capital sitter and mother, usually content with once a year. The eggs are tinted, from the Brahma descent. The pullets often lay at five months old. According to American standard, cocks should not be less than 8½ lb. and hens 6½ lb.; young birds 1 lb. less."

The particular variety above described is of course the silver-laced. There is also a variety known as golden-laced, in which the ground colours is golden, and the lacings and markings black, and a white variety. The latter, however, are seldom bred, and do not appear to have much reason for existence in view of the excellence and beauty of the white dorking.

As I have already intimated, there are comparatively few breeders of Wyandottes in New South Wales. I am pleased to note, however, that the number is on the increase. Probably the most successful breeder in this Colony is Mr. R. Coleman, of the Ferndale Nursery, Bathurst, who confines his attention to golds and silvers, and from whom I obtained the photographs from which our illustration is taken. His experience is all in their favour, and certainly the Bathurst district appears to suit them to perfection. It appears that the goldens are slightly the better layers, though both are good. The early-hatched pullets, some of which lay as early as 4½ months, generally lay a few eggs in the autumn, and then leave off until the spring, but those hatched rather late in the season may generally be relied upon to give eggs during the winter months, provided, of course, they have warmth, comfort, and proper attention. The Wyandotte lays on fat very readily, and therefore maize should be fed very sparingly.

It is notable that the English breeders have never been very successful in breeding the Wyandotte, and the most satisfactory specimens introduced into this Colony have invariably come from America. The breed offers plenty of work for the fancier, as there are so many points to be attained. The lacing should be distinct right down to the hocks.

I can with confidence recommend this breed, both to farmer and fancier.

With regard to the birds in our illustration, both are bred and owned by Mr. Coleman. The cock was first shown at the recent exhibition of the N.S.W. P.P. and D. Society, where he obtained first prize in his class, and eventually the silver cup for the best bird in four breeds, comprising Plymouth Rocks, Langshans, Orpingtons, and Wyandottes. This competition embraced no less than 239 birds, including a large number from Victoria. The hen also is a noted prize winner in the Western District.

Other breeders of Wyandottes:—Mr. T. Hall, of Fairfield; Mr. C. Brown, of Newbridge; Messrs. Silcock and Campbell, of Glebe Point; Mr. J. Spratt, Orange; and Mrs. W. H. Webb, of Bathurst.

Practical Vegetable Growing

Directions for the Month of November.

During this month weeds of all kinds make very rapid growth, and if they be not removed whilst young will soon overgrow many of the vegetables, the more so if the weather be moist.

Before spreading the droppings of animals as a mulch round vegetables, it would be advisable to heap the manure together and let it thoroughly rot to make it more suitable for vegetables, and to destroy all seeds of weeds. It should, if possible, be rotted under cover, so that the rain cannot wash away the best part of it. Whilst rotting, keep moist, so that it does not burn.

Beans, Kidney, or French.—In the warmest parts of the Colony, plants raised from early-sown seed should now be bearing pods large enough for use. It is a great mistake to allow the pods to grow to their full size before they are pulled, for they become hard, and almost unfit to eat. It is a still greater mistake to allow any to become ripe, for then the plant will cease to produce more beans. Keep the ground well hoed between the rows, and if the weather and soil are very dry spread over the ground a thick dressing, usually known as a mulch, of coarse dung, leaves, dead grass, sea-weed, dry fern, or anything similar that may be convenient. This will save the plants from wilting, or perhaps dying. If water is sufficiently abundant for use in the garden some liquid manure could be made from horse, cow, or fowl dung, and applied (say) twice a week. This will be found of considerable benefit to all vegetables. Burnt rubbish of any sort will be of great value, and it will always be worth while to cart on to the vegetable garden the remains of burnt stumps and logs and the burnt soil about them. Seed of French beans of the dwarf, runner, scarlet runner, snake, or butter varieties may be sown in any part of the Colony, except in those places where frosts still occur. There is always a certain amount of difficulty with the runner or tall-growing kinds of beans, because it is necessary to fix up sticks or some other kind of support for them to climb over. On the other hand, the dwarf varieties need no support, and are extremely easy to manage. Great mistakes are often made by persons who start vegetable growing without some instructions, in sowing their seeds too deep in the ground, and too close together. French beans should be sown about 3 to 4 inches deep, and from 6 to 8 inches apart. In cases where they have been sown too thick the young plants can be moved to another bed without affecting their growth, if they be well watered before the are lifted, and watered again after the transplanting.

Beet, Red and Silver.—Sow a row or two of seed in well dug up ground. If it is considered necessary to apply manure for the red beet, use only thoroughly well rotted dung. The best practice is to sow on ground that had been heavily manured for some previous crop. Freshly applied manure is likely to cause the roots to fork. As the silver beet is used for its leaves only, manure may be applied heavily.

Broccoli.—Sow a little seed and transplant any strong young plants you may have large enough to put out. This vegetable is very much like cauliflower and may be grown in the same manner.

Cabbage.—Sow a little seed occasionally, not much at a time but just sufficient to keep up a continuous supply of plants. Plant out a few strong young cabbages from the seed bed to some well manured ground. Cultivate well all the cabbages that have been planted out, and to improve their growth give them a good watering with liquid manure. Make a sort of basin round each plant by drawing away the soil to the depth of an inch or two. When the liquid manure has soaked into the ground, cover with the soil that had been drawn away. If the weather is very dry it will be advisable to spread a heavy mulch between the rows of cabbages or any other vegetables as advised for French beans.

Carrot.—Some seed may be sown in drills, and when the plants come up and have attained a fair size, thin out considerably. The ground should be well prepared by deep cultivation, and had better not be manured if it can be avoided, but it would be preferable to sow on land that had been heavily manured for some previous crop. The drills should be about 12 to 18 inches apart.

Cauliflower.—A little seed may be sown, either in a box or seed-bed, to be protected from the hot sun. Mulch the surface with some finely broken up dry cow-dung, and do not allow the soil to become dry.

Celery.—Sow a very little seed, if it is thought to be required, in a seed-pan or box, and if there are any plants available plant them out in richly prepared ground, either in prepared trenches or on the flat. A small bed of celery grown merely for flavouring soups, stews, &c., will be found of considerable value. In this case there will be no necessity to blanch the stalks. To grow celery well it requires plenty of well decayed farmyard manure and good supply of water.

Cucumber.—Sow seed in ground that has been well prepared by deep digging and rather heavy manuring. Draining should also be attended to. Any plants that are up and making headway should be pinched back as they extend their spreading shoots, in order to keep them bushy and compact. Plants which are not growing well should have some liquid manure from time to time, but this should be made very weak.

Cress and Mustard.—These two salad plants are usually grown together, and they are about as easy to grow as any plants can be. During the hot weather frequent applications of liquid manure will improve them and make them tender and crisp.

Egg Plant.—Plants from seed sown some little time back should be ready to plant out in the garden, 3 feet or more apart every way. It is hardly worth growing to any great extent until it is ascertained that this vegetable is liked by the family. Seed may be sown, if plants have not been raised.

Leek.—Sow a little seed in the seed-bed, for succession. It is always well to have a few young plants ready to put out when required. Any small plants that may not be required for the garden wiil come in useful for the kitchen, no matter how small they may be. The leek is a greedy plant, and needs plenty of manure, and is greatly improved by frequent applications of liquid manure and plenty of water. Plant out a few strong young leeks deep in the soil. Fair-sized plants that are growing well may be earthed up to make the stalks white and tender. This vegetable can be strongly recommended as being most wholesome.

Lettuce.—Plant out a few strong young lettuces from the seed-bed, but make the ground rich with well rotted manure before planting. They should be grown quickly at this time of year, or they will probably soon run to seed.

Melons.—Sow a few seeds in well-prepared ground, in the same manner recommended for cucumbers. The pie, or preserving melon, should not be forgotten, as it is very productive and useful for preserve.

Okra or Gumbo.—Plant out a few seedlings if any are available, but if not sow some seed. This vegetable is useful for soups and stews. Its young seed pods contain a considerable quantity of glutinous matter which is said to be wholesome and nourishing. The flowers are pretty and the plant may be grown for ornamental as well as useful purposes.

Onion.—Sow a little seed and keep the onion beds free from weeds. Scatter amongst any onions which you may have growing a mixture of soot and salt, half and half. This is a useful stimulant, and it will, in a great measure, prevent the attacks of worms and insects.

Peas.—A few rows should be sown, in cool and moist climates especially.

Peppers, Chilli or Capsicum.—Plant out a few seedlings and if required seed may be sown. A very few plants will serve for the purposes of a family.

Potatoes.—A few rows may be planted. Plant only whole potatoes of a medium size. Use plenty of rotten horse or cow dung.

Pumpkins.—Sow some seed in well-manured or rich ground. Plants that are progressing should be kept pinched back to prevent them rambling too much.

Radish.—Sow a little seed from time to time and use the plants as quickly as they are ready. Old radishes are almost useless and indigestible, and should be thrown to the pigs.

Rhubarb.—Sow a little seed in order to raise plants to put out next winter or early spring. This is a useful plant to grow, and no garden should be without it.

Spinach.—Sow a little seed, but very little.

Tomato.—Sow seed in such quantity as may be required, and plant out from the seed-bed if any plants are available. Keep large plants tied up to some support if possible, and the fruit will then ripen better and be less liable to rot.

Turnips.—Sow a little seed in rows.

Vegetable Marrow and Squash.—Sow a little seed in the same way as recommended for cucumber.

Orchard Notes for November.

DURING the first part of the month the fruit-growers of the coastal districts will do well to pay a little attention to an operation which, as rule, they entirely neglect, viz., to thin their fruit. Apricots and peaches especially are prone to over-bear, the trees being often completely covered with fruit which they are quite unable to bring to anything like perfection. Trees that are allowed to over-bear only produce inferior fruit, which is hard to sell; whereas, trees that have been properly thinned out produce fruit of a large size and best quality, which will always sell, no matter how dull the market, as a really choice article will always find buyers, and in no market that I know of is this so readily seen as in Sydney. The question of thinning fruit is a very important one, and it is one that every fruit-grower in the Colony who wishes to make fruit-growing pay will have to study and practice sooner or later, as the neglect of thinning is causing our markets to be flooded with a very large quantity of very small and inferior apricots and peaches, which are practically unsaleable, as the rubbish—I cannot call it fruit—is fit for nothing. The question of whether it will pay to thin fruit has been conclusively proved over and over again in California, and there the wages are by no means low, being about 30s. a week and board for white men, and 30s. a week, without board, for Chinese. The general experience of thinning in California has been that trees thinned produce regular crops year after year; not a very heavy crop one year, which cripples the tree, and takes the next season resting to make up for it; also, that trees bearing regular crops of large fruit require less manuring than trees that produce large numbers of pits and comparatively little flesh. It is the pits or stones, each of which in its kernel contains the germ of a tree, that take it out of the soil. The kernel contains a high percentage of nitrogen and phosphoric acid, the two most expensive plant foods which we have to supply in the form of manure, but the flesh of the fruit consists mainly of carbo-hydrates, which are obtained from the atmosphere and water. The main reason, however, that Californian fruit-growers thin their fruit is that there it does not pay to grow rubbish, which is of no value, and for which it is exceedingly difficult to find a market; whereas, large, even, good quality fruit is readily disposed of, no matter whether it is dried, canned, or consumed green.

In order to see that a judicious thinning will pay, choose a dozen trees of the same variety, of about the same size, and having about the same quantity of fruit on each. Leave six trees as they are, and thin the other six, so that every fruit that is left will have room to develop to its full size. Keep a full account of the cost of gathering and marketing the fruit from each lot of trees, and compare the net returns. I think many of our growers will be rather astonished at the result.

Apricots and peaches should be thinned just as soon as the second drop has taken place, or just as the stone begins to harden, as when thinned then there is no fear of any further drop, and the fruit taken off has not developed sufficiently to injure the tree. When thinning, one should have an idea of how much fruit the tree is able to bear without injury, and then thin accordingly.

With peaches, the fruit should be thinned to a distance of 4 to 5 inches apart, and where two fruits are growing together, either take off both or leave both, do not take off one and leave one.

With apricots, get the bulk of your fruit on the spurs along the main branches, and not right out on the ends of the branches, and thin out thoroughly so as to allow every fruit plenty of room. Large plums, such as Coe's Golden Drop, White Magnum Bonum, and Pond's Seedling will also pay well to thin, as also will pears and apples where too crowded. Where Codlin Moth, however, is very numerous, they will generally do all the thinning that is necessary, and often more than the orchardist cares about. Towards the end of the month the first crop of Codlin Moths will be reaching maturity, and this is easily detected by examining the affected fruit. As soon as the larvæ attain a fair size the bands should be placed round the trunks of the trees which should have been previously well scraped to destroy all larvæ wintering under loose bark or in crevices of the tree, and all rubbish such as old boards, stakes, or other pieces of timber that are likely to form a shelter for the insects should be removed from the orchard. During the month keep the orchard well cultivated, especially if the weather is at all dry—stir the ground don't turn it, and it will thus retain the moisture necessary for the proper growth of the tree and fruit. Keep down all weeds in the orchard as they only form a refuge for many injurious insects, and if the weather is at all dry every weed is robbing the tree of the moisture that it cannot do without. When there is irrigation available the orchard may be watered once during the month if required, but do not use too much water. Use no more water than is absolutely necessary, but give the land all the cultivation (stirring) possible to retain moisture. Examine orange and lemon trees carefully for any trace of the Rust Mite or Maori, and spray the trees with sulphur and soft soap at once if any are discovered. If Red Scale, Black Scale, or Broad Scale is troublesome, spray with kerosene emulsion to which as thick a solution of starch as will pass through the nozzle should be added. This will form a glaze or skin which will crack and peel off when dry, taking the scales along with it.

Attend to the work in the nursery, see that the trees are kept free from weeds, and that the ground is well stirred. Keep down all suckers—cut any ties that may not previously have been cut, and stake up any buds or grafts that may be growing crooked. During the month cherries will come in from the earlier districts, see that they are well and lightly packed, and the top well faced, as a little extra trouble in packing often makes a difference of over a penny a pound in the price of the fruit. As these notes have now been written for each month of the year, I think I cannot do better than conclude with the following advice which is especially applicable at the commencement of the fruit season, and that is to send nothing but good fruit to market, and to so grade it, pack it, and market it, that it will show off to the best advantage when instead of being a drug on the market, it will be readily sold, and instead of landing the grower in loss will bring him in a good profit.

Fruit-growing to be a success now, must be conducted on far different lines from what it has been in the past; the old easy-going lines for fruit-growers are gone, and the man who wants to make fruit-growing pay must keep up with the times, and use his brains as well as his hands.

He must keep his trees well pruned and judiciously manured—his orchard free from all kinds of diseases, and in the highest state of cultivation; and he must grow nothing but first-class fruit, which no matter whether it is used fresh, or is canned, dried, made into jams or jellies, or exported will be a credit to our Colony.

General Notes.

Selection of Seed Wheats.

Last month the Department took occasion to notify through the press of the Colony the distribution in pamphlet form of Dr. Cobb's article on this subject, which appeared in our April issue. This was done with a view to insuring the starting of experiments at the proper time. In the event of any farmer in a late district desiring to assist in the work a copy of this pamphlet will be forwarded on application to the Department.

Colonial Timbers for Wine Casks.

The following letter has been received from Mr. E. Wyndham, of Bukkulla Vineyard, Inverell :—" In an article published in the *Agricultural Gazette* of June, 1894, headed ' Colonial Timbers for Wine Casks,' Mr. J. H. Maiden mentions that he has heard colonial beech spoken of in the highest terms, as an excellent timber for wine casks, and asks ' is there any draw-back to its use.' I would answer, certainly not, for casks made from colonial beech obtained from the Richmond River—which I presume is the *Gmelina Leichhardtii* alluded to by Mr. Maiden—have been in use here for more than twenty years, in fact, it is the principal timber used by us for storing wine, and has never been found to impart any deleterious flavour, or to injure wine in any way. As to its lasting properties, it is probably inferior to Baltic oak, being a remarkably soft wood, which quality unfits it for hogsheads and quartercasks in which wine is to be sent to market. Its softness, however, does not render it porous, and I have not found that it permits a greater evaporation than oak. It has the great advantage of being comparatively inexpensive, the price being about 16s. per 100 feet at the saw-mills on the Richmond River. I can confidently recommend it as a most suitable timber for large casks that are to remain in the cellar and not be exposed to much rough handling. I am about to experiment with a timber well known all over New England as the ' River Oak,' and will acquaint you with the result if successful."

A Grass New for New South Wales.

Mr. G. L. Archer, of Coolootai, Inverell, has sent to the Department a small collection of grasses, and one of them proves to be an addition to the recorded plants of the Colony. Its botanical name is *Ischæmum laxum*, R. Br. (Synonym, *Andropogon nervosus*, Rottb.) It differs from the normal form mainly in the shortness of its spikes. It is probably not plentiful, but particulars in regard to this point are not available at present. The grass is nutritious particularly when young, but when old it tends to become wiry.

Hitherto this grass (normal form) has only been recorded from Queensland and northern Australia; it is also a native of tropical Asia and Africa. Its recorded Queensland localities are Peak Downs and the Rockhampton district; it is also found in North Australia, *e.g.*, about Port Darwin. As regards India, Mr. Duthie says that the grass is found in the hilly parts of Rajputana, Bunkelkhund, and the Central Provinces. He quotes Mr. Lowrie for the statement that it is one of the best fodder grasses in the Ajmere district.

There is no doubt that it is an addition to the decidedly useful indigenous plants of New South Wales.

A Plant supposed to cause Red-water in Cattle.

Mr. T. E. Cambourne, of the Rose Valley Public School, Gerringong, sends *Breynia oblongifolia*, Muell. Arg., to the Department with the report that in the district it is believed to cause Red-water in cattle. This plant is a straggling tall shrub usually 5 or 6 feet high, whose leaves turn black in drying. It belongs to the natural order *Euphorbiaceæ*, many of the plants comprised in which are either acrid or poisonous; nevertheless we require some further evidence before we may definitely say that it is a cause of Red-water in cattle.

The Chocho.

Excellent reports are to hand as to the success of this pleasant addition to our vegetable luxuries in the Clarence District. Mr. F. G. Bedford was most successful last season with a specimen obtained from the Department and in addition to an exhibit of chochos grown by him being recommended for a prize at the last Wingham Show he has been public spirited enough to present a large number to his neighbours so that the coming season should see a substantial growth of the vegetable. It should not be forgotten that the roots of this plant will shoot out and bear a crop in the second year and that after this a large tuber will be found underground which, in addition to being edible in the same manner as a yam, is most nutritious food for hogs. The chocho will be found a most satisfactory crop for pig farmers and can be utilised on all hands to cover unsightly fences and buildings. Although it gives the best results in the humid atmosphere of our coastal districts it will prove a good crop under irrigation in the easily worked loams of the warm western districts, and will bear fruit nearly all the year round away from the influence of frosts.

Review.

Odorographia.

A Natural History of Raw Materials and Drugs used in the Perfume Industry, intended to serve growers, manufacturers, and consumers; by J. Ch. Sawer, F.L.S. 2 volumes, Gurney and Jackson, 1892–1894.

The author's preface states: "An endeavour has here been made to collect together into one manual the information which has hitherto only been obtainable by reference to an immense number of works and journals in all languages. Information has been obtained first hand from growers and manufacturers at Nice, and Grasse in India, and other places. Methods of extraction and abstracts of patent specifications are given. The physical and chemical properties of pure products are described, enabling the operator to detect adulterations which frequently occur."

In an introduction the Author gives an interesting *resumé* of our knowledge of the sense of smell in the lower animals and man, aptly described in a late paper in one of the magazines as a "neglected sense." The bulk of the work is devoted to a critical account of all the important perfume and some drug producing plants. The range of subjects is consequently large. Space will not permit of any detailed list of the plants dealt with: two illustrations must suffice. The genus Eucalyptus occupies considerable attention; and although the matter suffers, as is naturally the case, from the want of a better knowledge of the group on the part of the writer than can be obtained from books, valuable information is gathered together, perhaps the most important points being that oil is obtained from numerous species, and that the leaves of the different species are no longer kept separate during distillation, the products in consequence varying indefinitely. This latter point is an important one, as in order to secure the most favourable result, uniformity is most necessary.

It is understood that Australia only does a small part of the trade in eucalyptus oil, California contributing largely from trees, be it noted, native to this country and alien to the United States. It is regrettable to notice that the eucalyptus oil trade is in a critical state owing to over production.

Indications seem to point to a more extensive use of this oil for disinfecting purposes. It has been lately pointed out as extremely valuable in this way. Extended experiments might be carried out in our newly completed hospital in order to test thoroughly its value in this direction.

Under the name "Souchet" the tubers of "nut grass" (*Cyperus rotundus*, a bad weed of cultivation which it is impossible to eradicate), are mentioned as being used in India, when dried and powdered, for perfume purposes, on account of their being scented. An essential scented oil is at times extracted from them. The fact may be recalled that another species of *Cyperus* is

found to yield useful eatable tubers; moreover, still another species yields a valuable oil. Many plants, out of place, as it were, called by us "weeds" are capable under certain circumstances of yielding valuable returns.

Many aromatic products could be grown to great advantage in New South Wales. The greater the variety of plants cultivated the better can "rotation of crops" be carried out. A market could doubtless be found for moderate quantities of for instance, ginger, caraway, thyme, mint, anise, rosemary, orris, frangipani, patchouli, aloes, and many others, in addition to those more generally used for scent purposes, either in the plant or raw product, or in the shape of scented fats, sweet waters, or essential oil; for it would appear that the industry is decidedly a profitable one.

Tyndall says somewhere, "that the use of pleasing perfumes is a distinct benefit to health, being refreshing and antiseptic," whilst they are protective at times—as, for instance, a few drops of peppermint or anise will prevent paste from becoming mouldy.

The volumes contain copious references, together with a list of the chief works consulted, supplied with an index and illustrations, they can be confidently recommended to those interested in the subject. To such, however, as have embarked in the industry they are indispensable, containing as they do a fund of valuable information never before collected into any one work.

C. T. M.

AGRICULTURAL SOCIETIES SHOWS, 1894.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindale	Jan. 9, 10.
Albion Park A. and H. Association	T. Armstrong ...	,, 17, 18.
Kiama A. and H. Association	J. Somerville ...	,, 25, 26.
Holt-Sutherland H. and I. Society	W. Douglas ...	,, 26.
Wollongong A. and H. Association	J. A. Beatson ...	,, 31, and Feb. 1.
Berry A. and H. Society	A. J. Colley ...	Feb. 6, 7, 8.
Gosford A. H. and I. Association...	H. S. Bevrendge...	,, 9, 10.
Luddenham A. and H. Association	K. Campbell ...	,, 13, 14.
Manning River (Taree) A. and H. Association ...	W. Plummer ...	,, 14, 15.
Lithgow A. and H. Society	M. Asher... ...	,, 15, 16.
Shoalhaven (Nowra) A. and H. Association ...	R. Leeming ...	,, 15, 16.
Ulladulla (Milton) A. Association...	C. A. Cork ...	,, 20, 21.
Marulan P. and H. Society	H. Morrice ...	,, 23.
Kangaroo Valley A. and H. Society	H. Joyce	,, 25, 26.
Candelo A. and H. Association	C. H. Brooks ...	,, 27, 28.
Tumut A. and P. Association	W. H. Bridle ...	,, 27, 28.
Tenterfield P., A., M., and H. Society	J. Harker... ...	,, 27, 28, and Mar. 1
Port Macquarie A. and H. Society	J. Y. Butler ...	,, 28 and Mar. 1.
Lismore A. and H. Society...	C. S. Connor ...	,, 28 and Mar. 1, 2.
Yass P. and A. Association	B. A. Nicholls ...	Mar. 1, 2.
Berrima District (Moss Vale) A., H., and I. Society	J. Yeo	,, 1, 2, 3.
Nepean District (Penrith) A., H., and I. Society	R. Benaud ...	,, 1, 2, 3.
Robertson Agricultural Society	R. J. Ferguson ...	,, 6, 7.
Uralla P. and A. Association	J. D. Leece ...	,, 6, 7.
Bega A. and P. Association	A. J. Wilson ...	,, 7, 8.
Inverell P. and A. Association	J. M'Ilveen ...	,, 8, 9.
Picton Agricultural Society	G. Bradbury ...	,, 8, 9.
Crookwell A. and P. Association	H. J. Peard ...	,, 8, 9.
Cobargo A. and P. Society...	J. Graham ...	,, 13, 14.
Tumberumba P. and A. Society	W. Willans ...	,, 13, 14.
Glen Innes P., A., and M. Association	J. Denshire ...	,, 14, 15.
Goulburn Agricultural Society	J. J. Roberts ...	,, 15, 16.
Gulgong Agricultural Association...	C. E. Hilton ...	,, 16, 17.
Armidale (Combined Show), A. and P. Association	W. H. Allingham	,, 20, 21, 22.
Taralga A. and P. Association	J. J. Walsh ...	,, 21, 22.
Royal Agricultural Society (Sydney)	F. Webster ...	,, 21 to 27.
Braidwood P. and A. Association...	G. F. Taylor ...	,, 22, 23.
Castle Hill A. and H. Association...	F. H. G. Rogers...	,, 26, 27.
Orange A. and P. Association	J. S. Thomas ...	,, 28, 29.
Walcha P. and A. Association	H. Chapman ...	,, 4, 5.
Lower Clarence (Maclean) Agricultural Society...	J. S. Dunnet ...	,, 4, 5.
Camden A., H., and I. Society	W. R. Cowper ...	,, 4, 5.
Gundagai P. and A. Society	W. E. Kyle ...	,, 5, 6.
Blayney P. and A. Association	G. H. Woolly ...	,, 5, 6.
Gundaroo P., A., and H. Association	J. Affleck... ...	,, 6.
Namoi (Narrabri) P., A., and H. Association ...	J. Riddle... ...	,, 11, 12.
Bathurst A., H., and P. Association	W. G. Thompson..	April 11, 12, 13.
Clarence (Grafton) P. and A. Society	T. Page	,, 18, 19.
Wellington P. and A. Association	R. Porter	,, 18, 19.
Hunter River (West Maitland) A. and H. Association	W. C. Quinton ...	,, 18, 19, 20.
Dubbo P., A., and H. Association...	G. H. Taylor ...	,, 24, 25, 26.
Warialda P. and A. Association	W. B. Giddes ...	,, 25, 26.
Mudgee Agricultural Society	J. M. Cox ...	,, 26, 27.
Williams River (Dungog) A. and H. Society ...	....	May 2, 3.
Coonamble P. and A. Association...	F. R. Salt	,, 2, 3.
Macleay (Kempsey) A. and H. Association ...	H. R. Gray ...	,, 9, 10, 11.
Gwydir (Moree) P. and A. Association	J. G. Cohen ...	,, 9, 10.
Hawkesbury District (Richmond) A. Association	C. S. Guest ...	,, 10, 11, 12.

Society.	Secretary.	Date.
Walgett P., A., and H. Society	P. W. Kenny ...	May 15, 16.
Upper Hunter (Muswellbrook) A. and H. Association	E. C. Brecht ...	„ 16, 17.
Upper Manning (Wingham) A. and H. Society...	P. Doust	„ 16, 17, 18.
Central Australia (Bourke) P. Association ...	J. P. Martin ...	„ 23, 24.
Cumnock P. and A. Association	W. Newmarch ...	„ 24.
Brewarrina P. and A. Association...	H. L. Cathie ...	June 5.
Warren P. Association	F. C. Thompson ...	„ 7, 8.
Cobar P. and A. Association	A. Roxburgh ...	„ 13, 14.
Nyngan P. and A. Association	E. H. Prince ...	„ 20, 21.
Urana P. and A. Society	H. A. Hill ...	July 17, 18.
Deniliquin P. and A. Society	H. J. Wooldridge	„ 19, 20.
Hornsby, Thornleigh, Pennant Hills, &c., H. Association	H. Epthorp ...	„ 23, 24.
Riverina (Jerilderie) P. and A. Society	J. Fulton	„ 24, 25.
Hay P. and A. Association...	F. W. Blanche ...	„ 26, 27.
Condobolin A. and P. Society	W. H. Garnsey ...	„ 31 and Aug. 1.
Narandera P. and A. Association	J. F. Willans ...	Aug. 1, 2.
Forbes P., A., and H. Association...	W. G. Dowling ...	„ 9, 10.
Corowa P., A., and H. Society	A. A. Piggin ...	„ 15.
Northern (Singleton) Agricultural Association ...	C. Poppenhagen ...	„ 15, 16.
Parkes P., A., and H. Association	H. S. Harwood ...	„ 15, 16.
Grenfell P. and A. Association	G. Cousins ...	„ 16, 17.
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* District National Prizes to be offered.

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[12 plates.]

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Useful Australian Plants.

BY J. H. MAIDEN,
Consulting Botanist.

No. 14. The New South Wales Blue Gum.

(*Eucalyptus saligna*, Sm.)

Other Vernacular Names.—The various trees which are grouped by botanists under the name of *Eucalyptus saligna* bear, in different districts, several different local names. *Eucalyptus saligna* is the common blue gum of the coast districts of New South Wales. The name "Blue Gum" has in Europe got to be almost exclusively associated with *E. globulus*, the Tasmanian and Victorian Blue Gum, which yields a whitish timber. The New South Wales Blue Gum is a red timber, of quite different texture. "Flooded Gum" is another name for *E. saligna*; I will allude to this later on. *E. saligna* is also a "Grey Gum," of which we have several in New South Wales. It is also known as "Redwood" on the south coast, and, to a limited extent, owing to its similarity in appearance to *E. longifolia*, it shares its name of "Woollybutt."

Uniformity of Nomenclature.—I could hardly choose a better species of Eucalyptus than this to point out the great practical difficulty of securing a uniform nomenclature for some of the species. Here the same species is consistently called in different parts of New South Wales and Queensland "Blue Gum," "Flooded Gum," "Grey Gum," and "Redwood." I have said that all these belong to one species. How then can a man say "Call each species by one common name, and one alone"? Let us see how that works out in practice :—

Blue Gum.—This name has already been appropriated by *Eucalyptus globulus*, the Tasmanian or Victorian Blue Gum, so that, beyond the Colonies, one must specify the Colony to be free from ambiguity. In other words, the term Blue Gum cannot be reserved for *E. saligna*. Suppose we ship home some paving blocks, labelled "Blue Gum" (as we in New South Wales know Blue Gum). They are bought, we will say, by a London Vestry. They order some more, and this time they receive "Blue Gum" blocks as different as can be in colour and other properties. They have been supplied with *E. globulus* this time. The surveyor of the Vestry says, "I will have no more of your Australian Blue Gum, which seems to me a very variable article, and upsets all my plans." The reply is, "Oh, but one is the Victorian sort and the other is the New South Wales sort." Mr. Surveyor answers, "I never was taught anything about New South Wales and Victoria when I was at school, but I do know something about Australia, and when I ordered Australian Blue Gum blocks, these people send me a red timber on one occasion and a white one on another. I will have no more to do with Australian timbers until Australians agree

about the names." Is this a fanciful dialogue? I think not, or rather I am sure not, both from what I have read, and from conversations I have had with Englishmen interested in Australian timbers. There is a great deal more in the nomenclature of our timbers than many people imagine, if we desire to develop and export trade in them, and when federation is an accomplished fact, I hope the Federal Parliament will make an enactment rendering it compulsory to export our timbers (no matter from what Australian port), under unambiguous names (as per schedule). I hope my readers will not think me joking. I am very serious. I have been for some time past preparing suggestions for an unambiguous nomenclature for our hardwoods, at least of those for export purposes.

Flooded Gum.—This name would do very well as far as distinctiveness is concerned, but in Australia the term has, as a rule, got to be associated with an inferior grade of timber, and I am, therefore, afraid that it would never become sufficiently popular to supersede the term Blue Gum, which is associated with timber of high quality.

Grey Gum.—This opens the question of the claims of the other candidates to the use of this term, and I do not think *E. saligna* has the best claim to the name.

After careful consideration, I have come to the conclusion that we had better adopt the term "New South Wales Blue Gum" for the present for *E. saligna*, pending the settlement of the question of a uniform official nomenclature for hardwoods for the export trade. Knowing the pertinacity with which country people stick to their local names, I have no hope that we shall be able to secure much reform in the use of names in the country district themselves.

Aboriginal Names.—According to the late Sir William Macarthur, the aborigines of the Illawarra used to call the Blue Gum "Couranga," while those of Brisbane Water called the Flooded Gum "Thurambai." The Flooded Gum of South Queensland is the "Toolur" of the aborigines, according to Mr. W. Pettigrew. It is the "Mungarie" of those of the Richmond River, New South Wales. By the Clarence River blacks it used to be called "Umbagga," according to Mr. Charles Moore, and "Warrimbarng" by those of the Hastings River according to Mr. Forester Brown. Mr. Forester Allan gives its aboriginal name as "Mudione" in the Illawarra.

Botanical name.—*Eucalyptus* (explained formerly). *Saligna*, Latin, signifying pertaining to a willow, in allusion to the leaves and habits of the tree, but the name is not a happy one, as the foliage is very seldom willow-like.

Fruit.—The shape of the fruit of the Blue Gum will, it is hoped, be clear from the drawing. As a guide, it may be remarked that, as a very general rule, there is a narrow space between the valves and the rim of the fruit wide enough for one to insert the thickness of the finger-nail or a pen-knife blade. If this little point be grasped it will be found to be useful. The fruit with which that of the Blue Gum is most likely to be confused is the Bangallay or Bastard Mahogany (*Eucalyptus botryoides*), and I would suggest that persons interested gather the fruits of the two trees and compare them for themselves.

Leaves.—I am not aware that the oil of these leaves has ever been described. The leaves apparently do not contain it in any quantity, judging by hand crushing, but it would be very interesting to have a sample of the oil to investigate its properties, work that I should be willing to undertake and publish the results in the *Gazette*, if any reader could supply such a sample.

Exudation.—I have very rarely seen kino of this species, and it would appear to be very scarce; in fact, settlers will tell you it yields none. I have only collected it in small quantities, and an old bushman "never knew it had any gum," although he often cut it up for felloes. As seen by me, it is of a dullish colour, of all tints of garnet. It is of a horny texture for the most part; it readily dissolves in cold water, forming a quite clear liquid of a dark orange-brown colour, with a small amount of residue of a Vandyke brown colour. Alcohol dissolves a portion of it, producing a tincture of an orange-brown colour. Analysis of a specimen procured near Sydney showed it to contain 35·56 per cent. of kino tannin, 4·6 per cent. of insoluble phlobaphenes, and 31·3 per cent. of gum. It is one of comparatively few Eucalyptus kinos which contain gum, and I have placed it in one of the three great groups into which I have divided Eucalyptus kinos, viz., the Gummy group.

Bark.—The Blue Gum is a smooth-barked tree, but it has more or less fibrous bark near the butt. Sometimes the fibrous bark is almost as absent as in the case of a White Gum, while in the case of some south coast trees it extends so far up the trunk as to make the confusion between this species and *Eucalyptus longifolia* (the woolly-butt) excusable.

Timber.—As Blue Gum, Flooded Gum, that particular Grey Gum ranked by botanists as a variety of *E. saligna*, and Redwood are recognised as distinct timbers by many people, it may be convenient to give notes in regard to each timber separately. It comes somewhat of a shock to some engineers to be informed that Blue Gum and Flooded Gum are botanically identical, for Flooded Gum is usually paler, more porous, shrinks more, is weaker, less durable, and altogether inferior to Blue Gum.

Blue Gum.—This is largely used by shipwrights and wheelwrights, and is one of the best kinds of timber growing in the Colony. It is a good all-round timber. It is durable. How long some of our hardwoods will last we cannot tell; the Colony is young yet. The late Rev. Dr. Woolls informed me some years ago that, to his personal knowledge, a coffin of Blue Gum was sound after burial for fifty years.

Blue Gum is straight in the grain, comparatively easy to work, and, therefore, for a hardwood, a favourite with carpenters. It is extensively used for building purposes, ships' planks, naves, and felloes of wheels, &c. It is of lower specific gravity than that of most of the Eucalypts, Flooded Gum being even more open-grained. It is the tree which gives the name to so many New South Wales localities which rejoice in the name of Blue Gum Flat—an indication of the alluvial soil it prefers.

Flooded Gum.—An excellent timber for ship-building, weatherboards, and general carpentry, but much inferior to Blue Gum. Mr. Charles Moore wrote of Clarence River Flooded Gum in 1862: "This timber is extensively used for building purposes, such as scantling, battens, flooring-boards, and for posts and rails, ships' planks, &c." I have no doubt that this tree is the same as the Flooded Gum of Queensland, to be alluded to presently. With respect to the value of the Queensland timber for fencing, a Byron Bay correspondent informs me that there is a difference of opinion locally as to its value for rails. He informs me that on a selection in Queensland posts of it were quite sound after twenty-three years.

In the catalogue of the "Timbers of Queensland," prepared by Mr. Walter Mill for the London Exhibition of 1862, he refers to a tree which he calls *Eucalytus grandis.* No description of the species was ever made, so that the name has no standing in science, but I have no doubt the tree is *Eucalyptus*

saligna. He describes it as "Flooded Gum—diameter, 4 to 5 feet; height, 90 to 140 feet. A majestic tree, inhabiting the rich alluvial flats upon the banks of the rivers, and in such has a pillar-like trunk, clear of branches for three-fourths of its entire height. The timber is in high repute for strength [subsequent knowledge has not confirmed this.—J.H.M.], lightness, (floats in water when dry), and durability, and it can be had in great quantities. Mr. Pettigrew, writing about this timber in 1877, says, "It is the lightest of all the gums hereabout, floating in water soon after being cut. It is easily cut by the saw, but shrinks very much in drying. It is used for weatherboards, and sometimes for making parts of drays and carts. Also used for masts, spars, and planks of vessels."

Grey Gum.—There are several grey gums, but this is the one chiefly known by that name in the north coast districts. Locally, it is highly esteemed, and Foresters Rudder and G. R. Brown are to be commended for the zeal with which they plead for its wider recognition. Following is an extract from a report by Mr. Rudder:—"It is in quantity, and up to 4 or 5 feet in diameter, but it is said the railway authorities will not accept it for railway purposes . . from want of knowledge of its true character. As to the lasting qualities of the grey gum in the ground, and generally, I have known it to be used for over forty years, and will stake my reputation on its excellence. Nor is it more liable, if as much so, as ironbark to the ravages of the white ant, and it is far superior to the broad-leaved ironbark (*Eucalyptus siderophloia*), which is so readily accepted for railway purposes."

Mr. G. R. Brown, of Port Macquarie, says of it:—"I recommend that grey gum may be used for railway sleepers and other purposes wherever practicable. In my district grey gum is almost as plentiful as the blackbutt, and only an odd log is used by the saw-mills. It is more easily obtained than ironbark, on account of being so plentiful nearer to water carriage, is distributed all over the district, and being so should tend to lower the contract price, being so easily obtainable. It is said to be equal to ironbark, except for girders, although it is often cut for girders, &c., and passed for ironbark."

Reference to the plate will show that the fruit of this grey gum differs from that what I may term the normal species, as represented by blue gum. I, therefore, term it *Eucalyptus saligna*, var. Mr. R. T. Baker and I have gone very fully into the botanical relations of this grey gum with blue gum and *Eucalyptus viminalis*, but the question is hardly suitable for further debate here. Those who are interested in the subject are invited to turn to the *Proceedings of the Linnean Society of New South Wales* for 1893, page 312.

Then grey gum is the Brisbane and South Queensland name for *Eucalyptus saligna.* Mr. Walter Hill described it many years ago as in good repute for rails, for fencing, and for building purposes, as it does not readily take fire. It is also both strong and durable. Mr. W. Pettigrew describes the local timber in almost similar language. He adds that fences of blood-wood (*Eucalyptus corymbosa*) for posts, and grey gum for rails, are considered the safest from fire, and the most durable against the attacks of white ants. Also, that grey gum is often split into shingles and sold for ironbark, very few people being able to challenge them.

I understand that a reason why grey gum is not accepted for sleepers is that the bolts work loose in the timber, which in good ironbark they never do.

Redwood.—In the Nelligen (Clyde River) district,—this is used by wheelwrights, chiefly for felloes, and the local saw-millers often go long

Eucalyptus saligna, Sm.

"Blue or Flooded Gum."
(Sometimes called Grey Gum.)

distances for it. It is a favourite timber for inside work. On the south coast this tree strongly resembles the woolly butt in the trunk, and the trees are, hence, often confused, local residents calling both *Eucalyptus saligna* and *longifolia* "woolly butt," with delightful impartiality. But woolly butt for *E. saligna* is wrong, and is, I repeat, the result of confusion. On the south coast the redwood (of course not to be confused with Californian redwood, so extensively used in this Colony), is not much used for posts or underground work, as it is not considered at all durable.

Size.—Up to 150 feet high and more, and a diameter of 3 or 4 feet, though exceptionally attaining a much greater size.

Distribution.—Confined to New South Wales and Queensland, and essentially a coastal and coastal-ranges tree. It does not extend further south, at least in workable sizes, than Currawang, a few miles south of Nelligen, on the Clyde River. North of this it is extensively diffused throughout the coastal districts of New South Wales, while it is fairly plentiful in Southern Queensland. The following data in regard to the distribution of the various woods ranked under *Eucalyptus saligna* has been supplied by the Forest Department:—

Eucalyptus saligna—Blue or Flooded Gum.

No. of F.R.	County.	Area in acres.	Class.	Size of Trees.	How distributed. Number of Trees.	How distributed. Over Area.	Royalty per 100 superficial feet.	Quality.	Remarks.
				girth. ft. in.		acres.	pence.		Locally called—
225	Argyle	6,340	A	3 6	over	6,340	..	good	Blue gum.
8,559	Auckland.. ..	2,027	A	8 0	5 ,,	1,300	..	,, ...	,,
14,150	Buller	15,750	A	..	....	....	..	,, ...	,,
14,162	Camden	10,120	C	..	....	....	6	,, ...	,,
242	Clarence	11,100	C	6 0	3 over	100	6	,, ...	Flooded gum.
1,662	Clarke	43,620	C	6 0	7 ,,	6,000	12	,, ...	Blue gum.
8,928	Clive	11,000	A	..	....	....	..	,, ...	,,
9,056	Cumberland ..	6,000	A	..	....	....	..	,, ...	,,
6,264	Drake	9,005	A	8 0	5 over	9,005	..	,, ...	,,
112	Dudley	2,453	A	6 0	1 ,,	200	..	,, ...	Blue and flooded gums.
158	,, ...	79,680	C	10 0	3 ,,	23,000	..	,, ...	Flooded gum.
3,753	,, ...	16,000	C	10 0	1 ,,	500	..	,, ...	Blue and flooded gums.
14,537	,, ...	47,205	C	9 0	....	200	..	,, ...	,, ,,
202	Durham	43,000	C	..	....	....	..	very good	Blue gum.
136	Fitzroy	12,440	A	8 0	1 over	1,000	..	good	Blue and flooded gums.
46A	Gloucester ..	26,700	A	8 0	1 ,,	2,500	..	,, ...	Blue gum.
1,608	Gresham	24,960	A	6 0	20 ,,	....	..	,, ...	,,
1,293	Hawes & Vernon	33,880	A	7 0	3 ,,	10,000	..	very good	,,
144	Macquarie ..	12,262	A	8 0	....	....	..	good	Blue and flooded gums.
70	Northumberland.	33,186	C	6 0	5 ,,	16,000	..	,, ...	Blue gum.
13,736	Raleigh	4,000	A	..	....	....	..	,, ...	Blue and flooded gum.
246A	Richmond ..	18,600	A	..	....	....	..	,, ...	Blue gum.
249	Rous	16,661	C	11 0	1	7,000	..	,, ...	Flooded gum.
10,616	St. Vincent ..	49,250	C	6 0	4	5,000	6	,, ...	Blue gum.
13,457	Vernon	7,800	A	..	....	....	..	,, ...	,,

Propagation.—From seed.

Reference to plate.—1. Fruits of grey or blue gum, Mount Victoria (the valves of the fruit are scarcely exserted); 1*a*. Fruits of grey or blue gum, Kanimbla Valley, Blue Mountains; 2. Blue or flooded gum, Port Macquarie; 3. Grey gum (*Eucalyptus saligna*, var.) of the county of Gloucester and other places in the North Coast District.

Grass-tree Gum.

BY J. H. MAIDEN,
Consulting Botanist.

So many inquires have been made during the last few months in regard to the various substances known under the above name, that it is hoped that the following account of them, based on a paper published by me in the proceedings of the Linnean Society of New South Wales, for 1890, will be found useful. Increased attention has been given to grass-tree gum in Europe lately, and I trust that the demand for the substance will be more continuous, and that more favourable terms will be offered to collectors, than has hitherto been the case.*

PART I.—PARTICULARS MORE OR LESS APPLICABLE TO ALL THE SPECIES.

Botanical Origin.

GRASS-TREE "gum" is the product of the various species of *Xanthorrhœa.* There are twelve species of this genius, which belongs to the Liliacæ, and several (perhaps all) exude resin from the caudex. A synonym of one or more species is *Acaroides resinifera*, Gray.†

Writers on the subject have usually simply alluded to the resin as that of *Xanthorrhœa*, without denoting the species, and sometimes without giving a description of the resin. Under these circumstances, it is frequently impossible to denote with certainty the species alluded to. Still, of the species obtained from Sydney, it may generally be said that the light (yellow) coloured resin is the product of *X. hastilis*, while the darker (red) one must have been obtained from *X. arborea.*

The plants are always known as "grass-trees" in the eastern Colonies, owing to the rush-like or grassy tufts of leaves which adorn the stem. In

* Some additional information, including notes on the principal localities for grass-trees, will be given in next month's *Gazette.*

† I have been at much pains to endeavour to trace this genus. It has nothing to do with Asa Gray's researches on some Australian plants, as it was in use at least as early as 1795 (see "BIBLIOGRAPHY"). It is not to be found in the *Genera Plantarum* of Bentham and Hooker, nor in any of the works of similar scope in the French and German languages to which I have had an access. I suppose, therefore, that it never had any claim to the acceptance of botanists, and it might be consigned to oblivion except that it originated the names "acaroid resin" and "gum accroides," which are to be seen in English standard works by the score. The former is even used in a work of high importance published recently (Morley and Muir's *Watts' Dictionary of Chemistry*). It is apparently a name coined by English druggists to denote a product which came to them without a name, and it has never been used in Australia so far as I can learn.

the very early days they were sometimes called "dwarf palm-trees." The term grass-tree "gum" is of course scientifically untenable, as it is insoluble in water; it is soluble in spirit and is a true resin. It is occasionally called "black-boy gum,"* and in English books now and then "acaroid resin" or "gum accroides." It is usually designated by the latter term in English drug-lists. It has also been called "Botany Bay resin."

Collection and Commerce.

The ordinary retail price of grass-tree gum is from 4d. to 6d. a lb. in Sydney, and the wholesale price of course much less. As usually found in commerce, the resin of *X. hastilis* is in very small pieces (almost powder), or else these small pieces are aggregated, forming a friable mass. In this state it is more or less impure, being mixed with soil and fragments of the bases of the leaves. *X. arborea* resin is usually in larger masses. After a bush-fire (or even the heat of the sun) has passed over grass-trees, the heat causes the resin to run into more or less spherical masses, which are sometimes also darkened, either from destructive distillation, or possibly by admixture with carbon particles. I have some pieces as spherical as if turned in a lathe. These masses can be picked out either from the interior of the charred stump, or from the ground at the place where a grass-tree once grew. Such masses present the resin in a very pure form, but collecting in this way would entail too much labour to be profitable commercially.

Following is a description of the method of obtaining grass-tree "gum."

The articles required are an axe, a flail, a coarse sieve, and a sheet. The stems of the grass-trees are chopped down, broken up into convenient pieces, and allowed to fall into the sheet. A stout stick or flail completes the work of disintegration. The substance is then passed through the sieve, the ligneous portions of the grass-tree for the most part failing to pass through its meshes. A gentle breeze is considered sufficient to winnow what has passed through the sieve, and render it ready for the market, though it often comes to Sydney without having been subjected to any winnowing process.

An interesting (though now somewhat out of date) account of grass-tree "gum," by Mr. P. L. Simmonds, will be found, *Pharm. Journ.* [2], viii., 78.

Following are some remarks on *Xanthorrhœa* resins by the expert appointed to report on such substances at the Colonial and Indian Exhibition (*Reports*, p. 286). Coming from such a source they carry weight, and are an encouragement to endeavour to properly place grass-tree "gum" on the market. The complaint as to the unequal quality of the commercial article should be taken to heart by those concerned.

"One may regard the resinous element of the *Xanthorrhœa* gums as the constituent more immediately to be utilised industrially, and one would suppose the European markets to be open to receive a very large amount of this material, if sold in such a form that the average consumer could see it readily. The crude gum does not look very attractive to the purchaser in the European market, as it contains a large—and what is worse, a very variable—percentage of matter insoluble in alcohol; and its purchase would involve an assay of each consignment, together with the attendant inconveniences, and the possibility of misunderstanding. Apart from this, it must be remembered that manufacturers—especially small manufacturers—have a rooted, and not altogether unreasonable, objection to use a variable

* In Western Australia most *Xanthorrhœas* are called "Black Boys," for the reason that a native boy with a tuft of grass on his head, and holding a spear, is thought to resemble, in outline, some of the arborescent ones.

article, as it disturbs the routine of their operations. All these considerations—to say nothing of the saving of freight—point strongly to the desirability of roughly purifying the resin before sending it to Europe. A sufficient purification is a very simple matter, and could be well carried out on the spot where the material is found, thus saving expense in land as well as ocean transit. It would suffice to soften the crude gum by heat, and to squeeze the softened resin through cloth or through a fine wire-netting, such as is used for straining gutta-percha. The heat of boiling water is sufficient for the purpose. The separated resin could well be put on the market as an approximately constant article—varying mainly as regards colour—and one which numberless small producers could use in their trades. The water in which the crude gum is boiled dissolves out more or less colouring matter, and also astringent or tanning substances,* and possibly, if the purification were undertaken on a larger scale, these might be turned to account."

Uses.

The aborigines prepared cakes of it for the purpose of fastening on the heads of spears, &c. The complete heads of W.A. spears are "stained with the gum of *Xanthorrhœa* to render them smooth and impervious to moisture" (Brough Smyth, i., 336, 340, 341). But I have no doubt that a good deal of the "black gum" which is frequently referred to in books as being used for that purpose, is the product of a *Myoporum*, probably *M. platycarpum.*

It is used by Chinese polishers, and also by some Eurepeans, as a substitute for shellac in French polishing; but its use for such a purpose is to be deprecated for the following reasons:—Work done with it is more or less sticky at first, though afterwards it frequently becomes so hard and brittle as to peel off like blistered paint. The result, whichever of the two things happens, is that French polish cannot subsequently be used on the article except after stripping. Other objections are that the wood darkens and often shows a play of colours. Also, water leaves white marks if splashed on the grass-tree gum polish; from benzoin or shellac polish it can be wiped off without injury.

Mr. Charles Moore (*Reports, Sydney Int. Exhibition*, 1879), states that grass-tree gum is "used for coating the bottoms of punts and small boats, and is said to be a good preservative."

It could probably be used in candle-making, for it burns by itself with a bright flame, and mixes with fat in all proportions. It is used in the manufacture of sealing-wax, lacquers, japanners' gold size, &c., and generally as a substitute for shellac. "An excellent spirit varnish" is said to be made from this resin by adding to about one gallon of methylated spirit (cold) about 2½ lb. of "gum," about ¾ lb. of common resin, and ½ lb. of shellac, and then straining through a muslin cloth.

The medicinal properties of grass-tree gum appear to be not well marked. As early as 1795 acaroid resin was said by Kite (see "Bibliography") "to neither vomit, purge, nor bind the belly, nor to act materially as a diueretic or diaphoretic." Dr. Fish (*Boston Journ.*, x., 94) employed it in the form of tincture with opium in fluxus hepaticus and the colliquative diarrhœa of phthisis, and it has been recommended in chronic catarrhs. A tincture of acaroid resin which has been given in doses of one to two fluid drams, with milk or a mucilaginous liquid, has been recommended to be made of equal weights of the resin and alcohol, and, according to another

* These products are only present in insignificant quantities, and utterly unworthy of commercial notice.—J.H.M.

formula, of 2 ounces of resin to 1 pint of alcohol. If used at all, the latter formula would appear to furnish a preparation of the proper strength." [Prof. H. C. Maisch (see "Bibliography").] I am informed that a chemist and druggist in a northern town uses grass-tree gum in cases of diarrhœa and dysentery. He powders the resin and gives from a half to a teaspoonful of the powder, mixed with mucilage (gum tragicanth) several times a day. The subject of medicinal qualities is further referred to under *X. hastilis*, p. 434.

The grass-tree gums have been repeatedly suggested as possessing some value in perfumery, but they are inferior for this purpose to benzoin, storax, and the balsams of Peru and tolu. Some of them which contain benzoic acid are aromatic when burnt, and owe their pleasant odour only or in part to that substance. Abundance of picric acid, a very powerful yellow dye, can be obtained from grass-tree "gum." But this substance can be so cheaply made from coal-tar, that grass-tree gum is not now thought of for that purpose. The result is that many storekeepers in the colonies, who eagerly bought up grass-tree "gum" as a speculation, with the view of exporting it to England, have for years past had stocks on hand, and quantities now sold have frequently been gathered, say, fifteen or twenty years.

PART II.—XANTHORRHŒA HASTILIS (THE SPECIES USUALLY ALLUDED TO BY THE EARLIER WRITERS AS GRASS-TREE "GUM.")

XANTHORRHŒA HASTILIS, R. Br., B. Fl., vii, 115.

Found in New South Wales and Queensland.

This remarkable plant, and its exudation of resin, attracted the very early attention of the first colonists. Probably their attention would have been invited to it in the first instance by the blacks, who still use it as a cement, as has already been mentioned. For the earliest actual allusions to the resin of *X. hastilis*, I am indebted to Barton's "History of New South Wales," pages 280 and 504.

On the 15th of May, 1788, Governor Phillip alludes to "the yellow gum which is found on the dwarf palm-tree."

On the 18th of November of the same year "an officer of Marines" speaks of "some of which have been used medicinally with success by the surgeon, Mr. Considen, particularly the yellow gum, a substitute for balsam of tolu." The statement is hard to comprehend, as grass-tree "gum" is as unlike balsam of tolu as it can possibly be, nor has its use in medicine been continued.

Both Surgeon-General White and Governor Phillip notice it in the books they wrote on the Colony. Following are their statements :—

"*The Yellow Resin Tree.*

"But the most valuable product of this plant seems to be its resin, the properties of which vie with those of the most fragrant balsams. The resin exudes spontaneously from the trunk; the more readily if incisions are made in its bark.* It is of a yellow colour; fluid at first, but being

*I have never heard of a *Xanthorrhœa* being subjected to this treatment. It has no bark, but shows scars of leaves like a tree-fern.

inspissated in the sun, it acquires a solid form. Burnt on hot coal it emits a smell very much resembling that of a mixture of balsam of tolu and benzoin, somewhat approaching to storax. It is perfectly soluble in spirit of wine, but not in water, nor even in essential oil of turpentine, unless it be digested in a strong heat. The varnish which it makes with ether is very weak, and of little use. With respect to its medicinal qualities, Mr. White has found it in many cases a good pectoral medicine, and very balsamic." (Dr. James Smith, in "Journal of a Voyage to New South Wales," by John White, Esq., Surgeon-General to the Settlement, 1790, p. 235. No figure of this plant is given, but some old basal leaves are figured.)

In "The Voyage of Governor Phillip to Botany Bay," 1790, a crude figure of this *Xanthorrhœa* is given, and (p. 51), concerning the resin, it says . . . "in appearance it strongly resembles gamboge, but has not the property of staining. . . . The resin is generally dug up out of the soil, under the tree, not collected from it, and may perhaps be that which Tasman calls 'gum-lac of the ground.'"

Its ordinary appearance in the bush is of a dirty crimson colour. It readily fractures, and it is then seen that this colour is only superficial, and that the resin is yellow or orange-coloured, strikingly like (in appearance) gamboge, and sometimes like the artificial Burgundy pitch of the shops.

It is well known for the pleasant perfume it exhales when exposed to sufficient heat to volatilise it without decomposing it completely. In Curtis' *Bot. Mag.*, 79, 4722, it is alluded to as "spear yellow gum," and the statement is made that it is "now used, we are told, as incense in the Roman Catholic churches of the Colony."

In Wagner's *Chemical Technology* (Crooke's), p. 484, the statement is made that "New Zealand resin, the produce of *Xanthorrhœa hastilis*, is now frequently used instead of shellac." No species of *Xanthorrhœa* extends to New Zealand, and the above is, perhaps, a typographic error for New South Wales.

The following are a few experimental notes on this interesting resin.

A sample collected by me near Sydney represents the resin in a very pure form, as no pains have been spared to pick out lumps free as possible from adventitious matter. It possesses a sweet odour,* similar to that of benzoin, which is much increased on powdering the substance. It fractures readily with a shining fracture, and is reducible with the greatest facility to an impalpable powder. No substance bears a greater resemblance to it than powdered gamboge, although that pigment is perhaps a shade darker. Exposure to the light causes the resin to change its colour to Indian red, which is the external colour of masses of pure resin. This colour is only superficial. It does not soften in the mouth, but crunches readily, tinging the saliva yellow, and tasting of benzoic acid to a far greater extent than *X. arborea.*

In boiling water the resin melts, the water becoming slightly turbid, and of a lightish yellow colour.

Petroleum spirit extracts 1 per cent. of a fragrant body, but apparently containing no benzoic acid.

* "When fresh it has an odour analogous to that of poplar buds, but much more agreeable (Guibourt), while Maisch likens the smell to benzoin mixed with a little storax. By age the odour becomes weaker, and gradually disappears, but it is always developed by powdering or by fusion."

Alcohol digested on the residue dissolves 94·6 per cent., forming a beautiful yellow liquid. As evaporation proceeds, benzoic acid, in beautiful feathery crystals, separates out, and the resin collects at the bottom of the vessel, the whole smelling strongly of benzoic acid. This resin melts at 97° C. Beyond applying the usual tests for that substance,* nothing further was done in regard to it, for lack of time.

The accidental impurity was 5·3 per cent. (vegetable *débris* and sand).

A second sample, purchased in Sydney, is in small pieces, admixed with a little ligneous matter. The description already given of this resin will apply here, except that it has a lower melting point, the heat of a Sydney summer fusing it and causing it to run together in the bottles. It is very strongly and deliciously aromatic. Petroleum spirit extracts 2 per cent. of a pale-coloured, sticky substance, which is probably a mixture of essential oil and resin.

A third sample, from Shoalhaven, N.S.W., collected 14th August, 1886, was then examined.

Petroleum spirit dissolves out 2 per cent. The general effect of cold alcohol and subsequent slow evaporation is the same in this sample as in that already described. The alcohol dissolves out 91·7 per cent. of resin and benzoic acid combined.

The residue (accidental impurity) amounts to 8·1 per cent.

This interesting resin has formed the subject of chemical researches for nearly 100 years. Following are abstracts from some of them—none of them recent. A modern research is a desideratum:—

"Of a darker reddish-yellow than gamboge, frequently covered with a greenish-grey crust. Brittle, of shining fracture, triturable to a greenish-yellow powder. Does not stick to the teeth. Tastes sour and aromatic, and has an agreeable balsamic odour. Contains a very small quantity of an agreeably-smelling volatile oil; a resin soluble in alcohol and ether, and also in alkalis and baryta, and lime water; a little benzoic acid and bassorin (Laugier. *Ann. Chim.*, 76, 265). Its solution in ether or alcohol leaves on evaporation a dark resin, containing, at 120°, 66·98 per cent. C, 5·73 H, 27·29 O, corresponding to the formula C_{40} H_{20} O_{12} and almost entirely precipitable from its alcoholic solution by water, even in the presence of a large quantity of ammonia." (Johnson, *Phil. Trans.* 1839, 292.)

"The resin gives up to boiling water benzoic acid and gum. It dissolves in oil of vitriol, forming a pale-brown solution, which is precipitated of a violet-red by water. It colours acetic acid yellow, without dissolving in it to any great extent, and dissolves easily in alcohol, ether, some volatile oils, and partially in fatty oils, forming in all cases fine yellow solutions" (Widmann; Lichtenstein) [Gmelin's *Handbook*, xvii, 386–7].

"Colour deep yellow, with a slightly reddish shade, considerably resembling gamboge, but darker and less pleasing. The colour of its powder is greenish-yellow. When gently heated it melts, and when strongly heated it burns with a strong smoky flame, and emits a fragrant odour resembling balsam of tolu. The resin contains a trace of an essential oil, to which much of its agreeable smell is owing. This oil passes into the receiver when the

* Stenhouse obtained a quantity of cinnamic acid, in far greater abundance than the benzoic acid, from a sample of *X. hastilis* resin examined by him. But, although I carefully examined the groups of crystals obtained, with regard to physical appearance, and also mixed both them and samples of the original resin with binoxide of manganese and sulphuric acid, I failed to obtain indications of cinnamic acid. I hope some time, however, to give the resin a more thorough examination.

resin is distilled with a mixture of carbonate of soda and water, but its quantity is so small that I was unable to examine it more closely. The resin is insoluble in water, but dissolves readily both in alcohol and in ether, especially in the former. Its solution in alcohol has a brownish-yellow colour; the addition of water precipitates it as a dark yellow mass, but it does not crystallise out of its alcoholic solution when left to spontaneous evaporation, but remains as a varnish. When digested with strong alkaline lyes, it readily dissolves and forms a brownish-red solution; and when the alkali is neutralised with muriatic acid, the resin is precipitated considerably altered as a dark brownish brittle mass.

"On concentrating the solution out of which the resin has been precipitated, and allowing it to cool, a quantity of impure reddish crystals resembling benzoic acid are gradually deposited. It requires repeated and long-continued digestions with the strongest alkaline lyes to remove the whole of this crystalline acid from the resin, which retains it with very great tenacity. The quantity of the acid is by no means great. It is not easily purified, as its crystals are apt to retain a trace of a reddish colouring matter, from which it is very difficult to free them. The easiest way of getting rid of it is by dissolving the impure crystals in a small quantity of alcohol and then adding water; the greater portion of the colouring matter is retained in solution, while the crystals are precipitated tolerably white. When purified by repeated crystallisations they become quite colourless. In appearance, taste, and smell they closely resemble benzoic acid.

"The quantity of carbazotic (picric) acid which Botany Bay resin yields when treated with nitric acid is so great, and it is so easily purified, that this resin seems likely to prove the best source* of that substance. When the resin is subjected to destructive distillation in an iron or copper retort, it yields a very large quantity of a heavy acid oil mixed with a very small quantity of neutral oil, which is lighter than water. If however, the resin has been previously digested with alkaline lyes, so as to remove all the cinnamic and benzoic acid it contains, the heavy oil is obtained as before, but none of the light essential oil. The acid oil is readily soluble in soda and potash lyes; in its smell and properties it resembles creosote; when it is digested with nitric acid, it is wholly converted into carbazotic acid, and when a slip of fir-wood is dipped in it, and then moistened with either muriatic or nitric acid, the deep blue colour passing quickly into brown, so characteristic of hydrate of phenyle, is immediately produced, with which substance the oil appears completely identical. The light oil above mentioned, the quantity of which is extremely small, is separated from the hydrate of phenyle by saturating it with an alkali and distilling the mixture in a glass retort with a gentle heat. In smell and properties it resembles benzine, and is most probably a mixture of benzine and cinnamene; unfortunately the quantity obtained was so small, that I was unable to subject it to more particular examination." (Stenhouse, *Phil. Mag.*, June, 1846.)

In *Journ. Soc. Chem. Ind.*, iv., 97, will be found a series of constants, by Mills and Muter, of bromine absorptions, for eight samples of *Xanthorrhœa* resin, comprising *X. hastilis*, *X. Preissii*, and possibly others.

* Superseded by coal-tar now, of course.

PART III.—OTHER SPECIES OF XANTHORRHŒA.

XANTHORRHŒA ARBOREA, R.BR., B.FL., VII., 115.

Found in New South Wales and Queensland.

A sample from Monga, near Braidwood, New South Wales, 4th and 5th October, 1886, is in large concentric masses, consisting of the remains of leaves (*in situ*) cemented together with the resin, the resin usually being so abundantly in excess that large pieces of the pure substance are readily obtainable. The inner portion of these masses is a true mould of the caudex. Where the resin weathers it is seen to be of a liver-colour, but it readily fractures (in a very similar manner to gamboge), and shows a very bright fracture. The colour is pleasing, and I can only describe it as of a rich purplish-brown inclining to crimson. It is readily reducible to a fairly fine powder, which is of a dull burnt-sienna brown, admixed with a few dark particles. The powder possesses a faint aromatic odour, from which the lump appears quite free. It tastes slightly of benzoic acid.

It softens in boiling water, but does not appear to dissolve to any extent. It almost entirely dissolves in rectified spirit, forming a rich port wine-coloured liquid.

Petroleum spirit digested on the resin extracts ·3 per cent. of a yellowish resin destitute of odour. If the residue be digested in alcohol, 94·2 per cent. is dissolved out. This consists almost entirely of a deep orange-brown resin. As evaporation proceeds, a few minute needles of benzoic acid are observed to crystallize out, while the concentrated alcoholic liquid smells slightly of the same substance. But in no instance was the benzoic acid in anything like the comparative abundance in which it was obtained in the case of *X. hastilis*. Therefore, when only these two resins are in question, they may readily be distinguished (1) by their colour, (2) by the difference in quantity of benzoic acid.

The accidental impurity amounted to 5·5 per cent.

Neither of this nor of any other *Xanthorrhœa* resins did time permit me to make a qualitative examination of the resin; nor were the products of distillation inquired into.

Sample from Oatley's Grant, George's River, near Sydney.

Petroleum spirit extracts ·3 per cent.

The effect of alcohol is the same as on the preceding sample. It extracted 89·8 per cent. The residue (9·9 per cent.) consisted of débris from the bases of the leaves, and no trace of free carbon could be detected by means of a lens. This observation is interesting in view of the statement I have made above (p. 749) to the effect that the darkening of *Xanthorrhœa* resin may be due to the presence of carbon after bush-fires. This particular sample was gathered by me from the midst of a freshly-extinguished bush-fire, where everything was black and charred, and the resin, dug up almost from the surface of the ground, was black likewise. The resin is a little darker in tint than the other samples of *X. arborea*, both before and after treatment with alcohol, an effect which seems simply due to the heat alone, without admixture of carbon. Numerous other samples will require to be collected and examined before this point is settled.

Three different *Xanthorhrœa* resins were found by Hirschsohn to be incompletely soluble in chloroform and ether, but to dissolve completely in alcohol, the solution acquiring a brown-black colour with ferric chloride.

"The solution of the acaroid resin is yellow,* and yields, with lead acetate, a precipitate, while the solutions of the other two resins are red, that of *X. quadrangulare* being not disturbed by acetate of lead, while that of *X. arborea* produces with the same reagent a turbidity; the chloroformic solution of the latter is yellow; that of the former colourless."

XANTHORRHŒA AUSTRALIS, R. Br., B.Fl., vii., 116.

Found in Tasmania and Victoria.

The shape which the resins of the various species of *Xanthorrhœa* assume are quite accidental. Some of these forms are described under various species, and refer to specimens which have actually been examined. The resin of this species "is found in masses of irregular globular shape, within the body of the tree, and exuding in large tears and drops near its roots. It is a dark-red friable substance, the purer homogeneous specimens exhibiting a most brilliant ruby colour when crushed into fragments; it fuses readily with the same deep colour, and exhales the characteristic odour of gum benzoin and dragon's blood under such circumstances. In many respects it resembles the last-named substance, but its solutions are less intensely red, inclining to yellow, while as a varnish it has much more body and gloss. It is very soluble in alcohol, and in the essential oils from the *Eucalypti*, that from the Dandenong Peppermint (*E. amygdalina*) proving an exception. Ether takes up a portion only, leaving behind a resinous substance coloured more intensely red than that which it dissolves; turpentine exercises no solvent action upon it, and the drying oils but very little." (*Report on Indigenous Vegetable Substances, Victorian Exhibition*, 1861).

XANTHORRHŒA PREISSII, Endl., B. Fl., vii. 117.

"Boro Blackboy."

Syn. *X. Drummondi*, Harv.

Found in Western Australia.

This grows from 20–30 feet high, and is said to produce more resin than any other Western species. From its tenacity, it is used by the natives in making their hatchets, hammers, &c., and in fixing the glass to their spears They also are said to make from it a bright yellow paint, with which they smear their bodies.

This species is referred to in the following:—

"In 1854, Captain Wray, R.E., submitted a report to the authorities of Western Australia on the manufacture of illuminating gas from grass-trees, at one-third the expense of lighting with oil and candles. The method of obtaining the material was as follows:—In the first instance, the leaves and resin were separated from the core by breaking up the plant with an axe, and sifting the resin from the leaves; but it was found by experience that as much gas was obtained from an equal weight of the leaves and resin together as from the resin alone. The quantity of resin obtained from an average "grass-tree" was about 45 lb. weight. This was collected easily at the rate of 5 lb. per hour by a person with an axe and sieve. The quantity of pure gas obtained was at least 4 cubic feet to the pound of resin and leaves; but much more might be obtained by a more complete apparatus. A cart-load of the plants, eight in number, weighed 1,048 lb. When the core was removed, the leaves and resin weighed 628 lb. The core is very

* *X. hastilis* is evidently meant here.

good fuel when mixed with other wood. The specific gravity of the gas is ·888. The products of the distillation are gas, tar, and coke. The tar obtained was about 1 quart for every 10 lb., and this, when redistilled, gave 8 per cent. of naphtha and 20 per cent. of a sweet, spirituous, non-inflammable liquor. The coke remaining was about one quarter the original weight, and with other fuel burns well. The coke of the leaf has a bright, shining appearance, and when ground with oil is a very good substitute for lamp-black in paint. The gas has a smell somewhat similar to coal-gas, not nearly so offensive, but sufficiently strong to make any escape immediately perceptible. Its illuminating power appears to be very superior to coal-gas, and its light very white." (Quoted by Mr. P. L. Simmonds in *Journ. Soc. Arts.*)

XANTHORRHŒA TATEANA, F. v. M., IN MUELL. CENS. SUPP. 1, for 1885.

Kangaroo Island, South Australia.

Some years ago I received from Mr. J. E. Brown, then Conservator of Forests of South Australia, the handsome resin of this new species. It is obtainable in large pieces, free from woody matter. Mr. Albert Molineux informs me that as much as a flour-bag (4 bushels) of the resin has been gathered from three stumps, the upper part down to the ground not being included. It is more or less vesicular. It breaks up and powders with the utmost facility. The fresh fracture is very bright, and of a rich, pure, ruby colour. The powder is dull, and of the colour of excellent chrome-orange. The colour of the lumps, originally of a ruby colour, becomes dulled by the friction of the masses against each other, and so becomes from liver-colour to chrome-orange.

Neither in lump nor in powder has the resin any odour at ordinary temperatures.

The finely-powdered substance give up a little colour (yellow) to cold water, when digested in it. The colour appears to be most marked in this species, although in other *Xanthorrhœa* resins there is a trace of colour. When the water is heated, the resin melts and becomes of a blood-red colour, the liquid becoming turbid at the same time.

Petroleum spirit extracts ·1 per cent. of resin, which appears to be without colour, and is without odour. Rectified spirit dissolves the whole of the remainder (there is but a trace of impurity), forming a beautiful ruby-coloured liquid. Benzoic acid crystallizes out from the resin, and appears to be intermediate in quality between that yielded by *X. arborea* and *X. hastilis*, under similar circumstances.

A TENTATIVE BIBLIOGRAPHY OF GRASS-TREE GUM.

BAMBERGER (M.) The Analysis of Resins and Balsams. *Monatsh.* 1890, xi, 84. *Journ. Soc. Chem., Ind.* ix, 659. *Jour. Chem. Soc.*, lviii, 1032. This paper gives "methyl numbers" of "Red and Yellow Xanthorrhœa Resin."

BAMBERGER (M.) On Xanthorrhœa Resins. *Monatsh.* 1893, xiv, 333. *Journ. Soc. Chem., Ind.*, xiii, 47. *Journ. Chem. Soc.*, lxvi, 47.

BOLLEY (P.) Amount of Picric Acid obtained from Botany Bay Resin. *Chem. Gaz.*, 1859, 136.

De Candolle. Organographie Végétale. Tom. I. [Referred to in Bennett's "Wanderings of a Naturalist," i, 62, where he states that "the analysis of the chemical properties of Grass-tree Gum is mentioned in the above work."]

Fish (Dr). Employed Grass-tree Gum in conjunction with opium in diarrhæic complaints. *Boston Journal*, x, 94. *Year Book of Pharm.*, 1881, 196.

Gmelin. The Yellow Resin of Botany Bay. [*See* Vol. xvii, 386, where a bibliography is given.]

Hlasiwetz and Barth. Grass-tree Gum. *Year Book of Pharm.*, 1881, 195.

Johnston (J. F. W.) Acaroid Resin (Botany Bay Resin, Yellow Gum). "On the Constitution of the Resins." Part ii. *Phil. Trans.*, 1839, p. 292.

Kite (Dr.) "Medicinal effects of the Resin of *Acaroides resinifera* from Botany Bay." Dr. Kite, of London, published a pamphlet under the above title in London in 1795.

Laugier. Published on Grass-tree Gum in 1825, according to Pereira.

Lichtenstein (Prof.) "On Botany Bay Resin." *Crell's Journal*, 1799, quoted by Dr. T. Thompson in *Chemistry of Organic Bodies* (*Vegetables*), 1838; by Pereira and others.

Ligar (C. W.) Grass-tree. *Trans. Roy. Soc., Vic.*, vii., 145 (1865–6).

Maisch (J. M.) "Notes on the Xanthorrhœa Resins." *Amer. Journ. Pharm.*, May, 1881. *Journ. Pharm.* [3], xi, 1005.

Mills and Muter. "On Bromine Absorptions." *Journ. Soc. Chem., Ind.*, iv, 96. Resins of various species of *Xanthorrhœa* are experimented upon amongst others.

Schrader. Quoted by Pereira as having experimented upon Grass-tree Gum, *circa* 1825.

Simmonds (P. L.) Grass-tree Gum. *Pharm. Journ.* [2], viii, 78.

Stenhouse. "Observations on the Resin of the *Xanthorrhœa hastilis*, or Yellow Gum Resin of New Holland." *Chem. Soc. Mem.*, iii, 1845–8, 10-12. *Pharm. Journ.*, vi, 88.

Trommsdorff. "Volatile Oil of Botany Bay Resin." *Taschenberg*, 1826, 9; *Gmelin*, xiv, 362.

Watts. Acaroid Resin. *Dict.*, vi, 2.

Watts. Paraoxybenzoic Acid. *Dict.*, vi, 898.

Widman. Quoted by Pereira as having experimented with Grass-tree Gum about 1825.

Native Fig Juices and Caoutchouc (India-rubber).

The following correspondence settles for the present a vexed question:—

Department of Mines and Agriculture, "Forests,"
Sir, Sydney, 27 April, 1894.

You are aware that ever since the paper of Warren de la Rue and Hugo Miller (Phil. Trans., 1860; Journ. Chem. Soc., 1862, p. 62; Watts' Dict., ii, 646) spasmodic attempts have been made to extract the caoutchouc which is contained in the juices of our native figs, notably *F. rubiginosa* and *F. macrophylla*. The latest and most serious attempt to ascertain the chemical composition of these juices is a paper by Professor E. H. Rennie and G. Goyder, entitled "The Resins of *Ficus rubiginosa* and *F. macrophylla*" (Preliminary notice); Journ. Chem. Soc. LXI, 916.

In order to satisfactorily ascertain whether extraction of the caoutchouc from these fig-tree juices can be profitably carried on in New South Wales, I am anxious to learn the most approved method of dealing with juices of this class. I have read with interest the following articles in the *Kew Bulletin*:—

(*a*) Lagos Rubber (*Ficus vogelii*, Miq.) November, 1888, p. 253.

(*b*) West African Rubbers, March, 1889, p. 63.

(*c*) Lagos Rubber, May, 1890, p. 89.

These all refer to Ficus juices, and it is perhaps a fair inference that our trees should be dealt with similarly to the West African ones, and that the resulting products are similar.

I gather from the above reports that the experiments of Mr. Alvan Millson at Lagos, in the matter of extraction of the India-rubber (caoutchouc) from the Ficus juices are not altogether satisfactory, and some friendly criticism was given by the India-rubber, Gutta-percha, and Telegraph Works Company of Silverton (p. 258, November, 1888); but neither in this, nor in subsequent issues of the *Kew Bulletin*, do I find explicitly stated what is the method recommended for the treatment of the Ficus juice. At certain seasons of the year the juice (*latex*) of our native figs flows freely and abundantly if the tree be cut with an axe. This juice could readily be collected in vessels. I shall be glad if you will kindly inform me how this juice should be treated, and in what quantity, and in what condition, should the sample be that I should send to London with the view of obtaining expert opinion in regard to the probable commercial value of the article.

By this post I send you a specimen of Ficus juice, and also one of crude caoutchouc—"obtained by evaporation"—by a correspondent of this Department. They are small specimens, and I have not broken the seals since I received them, as fermentation may be set up. I do not know whether they will be of any assistance to you in giving me the advice I ask for, as I presume

you will require to see the caoutchouc prepared according to the method you will suggest; meantime, any information and suggestions will be much appreciated.

I have, &c.,
T. M. SLATTERY.

Professor W. J. Thiselton-Dyer., M.A., C.M.G., F.R.S.,
Director, Royal Gardens, Kew, England.

Office of the Agent-General for New South Wales,
Westminster Chambers, 9, Victoria-street, Westminster, S.W.,

Sir, 3 August, 1894.

Referring to your letter of the 27th April last, transmitting two bottles of Ficus juice, for the purpose of ascertaining from Professor Thiselton-Dyer advice as to how this juice should be treated, &c., in order to obtain expert opinion in regard to the probable commercial value of the article, I have now the honor to inform you that I duly forwarded to Professor Thiselton-Dyer the samples referred to, together with a copy of your letter under acknowledgment, with a request that he would be kind enough to comply with your wishes in this behalf, and I send herewith a copy of a communication he has addressed to me in reply upon the subject.

In accordance with the suggestion made by Mr. Thiselton-Dyer, and with a view to obtain the fullest possible information, I addressed a letter to "The India-rubber, Guttapercha, and Telegraph Works Company (Limited)," forwarding the samples in question, with a request that they would advise as to how this juice should be treated for the purpose of making it marketable and suitable for manufacturing purposes, and inform me of its commercial value, and I send herewith, for your information, a copy of their report upon the juice, from which you will observe that they state they have not been able to give an estimate of the value of the materials in question, as it was impossible for them to do so with such small samples as were sent by you, and that they would require at least 28 lb. of each sample.

I return, under separate cover, the samples in the condition they were received in this Department from "The Indiarubber, Guttapercha, and Telegraph Works Co. (Limited)."

I have, &c.,
SAUL SAMUEL.

The Honorable The Secretary for Mines and Agriculture, Sydney.

Sir, Royal Gardens, Kew, 21 June, 1894.

I have the honor to acknowledge the receipt of your letter of 19th June (2,850–94), on the treatment of the milk of certain species of Ficus in New South Wales, for the purpose of obtaining india-rubber.

2. Although most species of Ficus yield a milky juice, I am not aware that any species at present produces a commercial article except the well-known *Ficus elastica* of Assam.

3. The problem which the Department of Mines and Agriculture has before it is precisely similar to that which baffled the Government of Lagos in the case of *Ficus vogelii*. Mr. Slattery seems fully acquainted with the literature of the subject, and I am in possession of no further information upon it. There is no general method known for separating caoutchouc from the "milk" in which it is mechanically suspended. The methods in practical use vary in different countries and with the different kinds of

trees from which the milk is drawn. Samples of milk have been repeatedly sent to this country for the further investigation of the problem how best to produce "coagulation." But this can only be advantageously studied on "fresh" samples. When they reach this country they have ordinarily undergone so much alteration that no practical results are attainable. All that can at present be said on the subject will be found by a careful study of the articles in the *Kew Bulletin*, cited in Mr. Slattery's letter.

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5. The samples accompanying your letter are herewith returned. Nothing can be done with them at Kew. If some investigation of them is thought desirable, though I do not think myself that it would lead to any useful result, the assistance of the India-rubber, Guttapercha, and Telegraph Works Company (Limited), at Silvertown, might be invoked.

I am, &c.,
W. T. THISELTON-DYER.

The Hon. Sir Saul Samuel, K.C.M.G., C.B.,
Agent-General for New South Wales.

Dear Sir, Silvertown, London, E., 30 July, 1894.

Re Ficus Juice.

We are in receipt of your letter of the 5th instant (Reference 2,851-3,241), together with the two samples of Ficus juice referred to therein.

These we have subjected to analysis with the following results (in the absence of any distinct mark on the samples, we refer to them as Nos. 1 and 2):—

No. 1 was contained in a wide-mouthed bottle, and was in the form of a solid, a sample of which we return as requested. It yielded about 7 per cent. of a substance closely resembling India-rubber, and about 73 per cent. resin. It is probably of no use as a source of India-rubber.

No. 2 came to hand in the form of a milky liquid, and yielded, after being evaporated to dryness, 7 per cent. of a substance similar to caoutchouc and 89 per cent. of resins. We send you a sample of the dried juice. This was simply evaporated in an open vessel without heat, which would be the best way of obtaining it should it be found hereafter to have a commercial value.

We also send samples of the resins extracted by alcohol.

In the above report we have not been able to give you an estimate of the value of these materials, as it is impossible to do so with such small samples; we should require at least 28 lb. of each.

We may say that the original liquid No. 2 was all used up, and in consequence we are unable to return you any in that condition.

We are sending the box containing the results of our experiments per parcels post.

We remain, &c.,
The India-rubber, Guttapercha, and Telegraph Works Co. (Limited).
C. H. GRAY,
Manager, India-rubber Department.

The Hon. Sir Saul Samuel, K.C.M.G., C.B.,
Agent-General for New South Wales.

Ringbarking in Western New South Wales.*

By THOMAS KIDSTON,
Forester.

The diversity of opinion on the utility of ringbarking timber has always been a matter of surprise to me, whether it is beneficial to the country or the contrary. As we go further west from the Blue Mountains the rainfall steadily decreases, till in dry years it reaches a minimum of 5 to 7 inches annually. When several years of drought occur in succession, a period of stagnation in timber growth sets in, the hardwoods can barely hold their own, vitality seems to leave the central, matured timber, and to be only active in the sapwood and bark, the interior of the trees becomes rapidly destroyed by the white ant, and nothing is left but a shell. In many thousands of such trees, cut in the mining districts of Mount Hope, Nymagee, and Cobar, and along the telegraph lines, I have never seen a hardwood tree (Eucalypt) sound at heart over 10 inches in diameter. They can only be regarded as large weeds, which exhaust the plant food of the soil. It does not appear to be generally known that when permission is granted to a lessee of Crown lands to ringbark, not only are any blocks of valuable timber trees reserved, but that certain kinds of trees, and good trees of any kind, fit for sawing, splitting, or shade, are not permitted to be destroyed. Indiscriminate ringbarking, such as obtained in former years, when everything was cut down, and no distinction made between good timber trees and hollow, stunted, and worthless rubbish, is, of course, to be condemned, and this rendered the formation of the Forest Department a necessity. With the above reservations, however, permitting and encouraging the sweeping away of noxious and worthless forest growths, opens up and promotes the occupation of the land, benefits the lessee, develops the capabilities of the soil, and must greatly enhance the value of the land as an asset of the Crown. Short of personal experience, no one could conceive the difference between a country thickly covered with box or belar, with yarran pine and other scrubs, before and after being ringbarked and scrubbed. In the one case, 25 to 40 acres are found necessary to keep a sheep in a miserable hunted condition; in the other, the same country will keep and fatten a sheep to an acre. The timber, while growing, reduces the grazing capabilities 75 to 90 per cent., and greatly impairs the nutritive qualities of what little grass may grow on it. It should not be forgotten that our annual rainfall varies from 18 to 5 inches. Between 1883 and 1886, inclusive, the rainfall was much below the average, and young

* The above article is printed as expressing the opinions of a gentleman of experience of the subject treated. They are, however, to be accepted as his opinions, and the fact of their publication does not imply any indorsement on the part of the Department.—ED. *A.G.*, N.S.W.

pine grew very little during these years. On upland country, with thin surface soil, it was attacked by a parasitical worm, and died in large quantities. In 1887 young pine grew more than in the five preceding years. As the white ant does not readily attack the pine, it thus becomes the most valuable and useful timber we have, being almost the only large timber having this property. In most other respects it is inferior to the pine timber of other lands. When seasoned, it becomes very brittle, has little tenacity, each nail-hole has to be bored, is difficult to plane and work, and is of low breaking strain.

The only timbers excelling it in value are the river gum and the ironbark, both of which, unfortunately, are found in very small quantities.

I entirely dissent from the opinion that forest destruction diminishes rainfall. I have been through Lower and Upper Canada, Nova Scotia, and the New England States of North America, where the greatest amount of timber cutting has taken place in the world's history, in a like time, and yet rainfall statistics show that during the last sixty years the rainfall has slowly, yet continuously, *risen*, and one of the most eminent meteorologists (Prof. Marsh, from memory), after a life-long study, has recorded his opinion "that rainfall is not increased or diminished by anything that man has done, *but by some great cause, external to the earth.*" In this western country, if ridden over a fortnight after a fall of 2 or 3 inches of rain, it will be found soft and boggy, if ringbarked, but the adjoining unringed country will be comparatively firm and sound. In the latter (green timbered country), the enormously increased evaporating surface of the leafage, compared with the area of the plot occupied by the tree, has carried the moisture off into the air, which is still retained in the soil among the dead ringbarked timber, and the grasses are nourished long after the soil among the live trees is parched and dry. The main cause of the water disappearing more rapidly from rolling or hilly country now than formerly is the solidification of the soil by the trampling of stock, more especially sheep. In Western Queensland, or any new country, before being stocked, the surface was soft and spongy, and a large part of the rainfall sank directly into the soil. Now, when trodden down and hardened by stock, the water more readily runs off, and so tends to form creeks and waterholes, which did not formerly exist. The sheep also trod into the damp soil the pine seed, which formerly perished on the surface, or was swept into the rivers by heavy rains. Hardening the surface soil will account for the more rapid rise of floods and the greater erosion of river banks.

In the consideration of these views, the climatic conditions of the district must be taken into account, as they are only intended to apply to the part of New South Wales west of Wagga Wagga, Forbes, and Nyngan.

Reserves of indigenous timber should be formed at short intervals all over the Colony, wherever it can be found of sufficiently good quality. The large areas of scattered pine which have been ringbarked have often been the subject of comment or discussion. Now, there were at least 35 to 40 millions of acres between the Murrumbidgee and the Darling more or less covered with pine, all of which was rapidly becoming a dense pine scrub, which would have ruined the grazing use of the land to this extent if allowed to go on. I have counted fifty-six young pines on a superficial square foot, which, of necessity, utterly destroys the possibility of any profitable use of the soil. To that extent the grazing industry would have been ruined, carrying with it all the industries dependent on it, and this really embraces all the other industries existent here, with the exception of the mining. Even the selector, who, by taking contracts for tank sinking, fencing, &c.,

is thereby assisted to pay his rent. Unless ringbarking and scrubbing had been allowed, under conditions, the country must have reverted to the occupation of the kangaroo, the wallaby, and the warrigal. Surely no one will contend that 40 millions of acres of the rich lands between the Murrumbidgee and the Darling should be left locked up in reserves of pine forests. Certainly not, if my estimate of its comparative value as a timber be any approximation to the truth. Had permission not been granted to keep it within bounds, this fine country must have become like the pine barrens of Georgia and South Carolina. But we are by no means done with the pine timber and scrub. Very far, indeed, from it. On all the lands which have been ringbarked a prolific crop of young trees has come up, so that for many years a reserve of this timber could be made that would, in time, secure any quantity which might be desired.

Notes on Fruit-growing at Mildura.

By ALBERT H. BENSON,
Fruit Expert.

Having been appointed to represent the New South Wales Department of Agriculture at the Intercolonial Convention of Fruit-growers held at Mildura on August 7th and 8th last, I think a short account of the work of the convention, as well as of my visit generally, may be of interest and, possibly, of some value to the fruit-growers of this Colony. The convention, which was organised by the Mildura Horticultural Society, was attended by delegates from New South Wales, Queensland, South Australia, Tasmania, and Victoria, for though Mildura is in Victoria, yet it is so far from any other settled district that it is in reality a small Colony by itself, and delegates from all the principal fruit-growing districts of Victoria were present. At the convention a number of papers treating of the fruit industry in general and of the questions of co-operation, export and fruit pests in particular, as well as several valuable papers on cultivation, pruning, propagating, brandy-making, &c., were read, and will be published by the Mildura Society. Unfortunately, there were far too many papers on the programme to deal with properly in the time, consequently several were taken as read, and there was little discussion on any of the others. This, in my opinion, was a great mistake, as the discussion that should follow the reading of a paper is often of more value than the paper itself, for, no matter how good the paper may be, there are always points that should be brought out and discussed. It is on these points very often that the value of the paper depends, so that it is always advisable to have them thoroughly thrashed out.

The great feature of the conference was the extraordinary unanimity of opinion amongst the delegates regarding the necessity for concerted action on the part of fruit-growers in all the Australian Colonies to deal effectively with all matters of vital importance to the fruit industry, especially the questions of fruit pests, export, developing new markets, and fruit nomenclature, and, as a result of this unanimity, it was decided to form an Australian Federated Fruit-growers Association, the preliminary steps in the formation of which are now being taken. It is only by concerted action on the part of all the Australian Colonies, and of the fruit-growers in each Colony, that we will ever be able to place the fruit-growing industries of these Colonies on a thoroughly sound basis, and be able to hold our own in the markets of the world. The time has now come when we must look beyond these Colonies for a market for our produce, and it is only by concerted action that such markets will be developed and maintained.

By concerted action we shall also be able to minimise the loss from fruit pests of all kinds, and also be able to straighten up the very mixed fruit

nomenclature, so that a fruit instead of being known by a different name in every Colony, and often by different names in different parts of the same Colony, shall have one name, and one only. Another point, and one that I touched upon at the conference, is that with concerted action we will be able to have a standard measure for fruit. Our present system is simply absurd, and why fruit should not be sold by a standard measure, the same as wheat or wine, so that the buyer knows exactly what he is purchasing, I fail to see.

Another feature of the Conference, and also of the journey to and from Mildura, when numbers of delegates travelled together, was the earnestness of the delegates, the interest they took in all matters under discussion, the desire to do good work and accomplish something that would further the welfare of the industry, the readiness and willingness with which information was given, and the desire which was shown to help each other by pulling together in all matters of vital importance to the fruit industry.

Advantage was taken of the Conference to hold a citrus fair, and the delegates were enabled to form a very fair opinion of the productions of the settlement, as the show was by no means confined to citrus fruits, but there was a very fine display of dried fruits, jams, jellies, wines, brandies, olive oil, pickled olives, &c. There was also a grand display of tropical and semi-tropical fruits and economic products that were exhibited by the Queensland delegates, which was a credit to our neighbours in the north, and a practical illustration of the energy of its delegates.

In conjunction with Mr. L. G. Corrie, of Brisbane, I was appointed to judge the citrus and other fresh fruits, Mr. Corrie standing out when any Queensland fruits were competing. The citrus fruits were a very fine lot, and included many specimens of really first-class quality fruit, especially some of the fruit from imported Californian trees, and some of the Queensland fruit. The great competition was for the collection of citrus fruits, of which not less than twelve cases in all, or less than half a case of any one variety, was to be shown, and for this there were only two competitors—Lord Ranfurly and Messrs. Fagan Bros. of Dural. The fruit from Old Mildura, though grown on trees that are not five years old, was, as a whole, decidedly superior to the Dural fruit, the Washington Navels and cured Lisbon lemons being especially fine. Where the Mildura fruit was superior to the Dural fruit was in the flavour and absence of rag. The skins of some of the Mildura fruit were, however, decidedly coarse, but this was fruit grown on trees purchased in the Colonies, and not any of the imported varieties. All the oranges grown at Mildura are by no means of good quality; in fact, the bulk are decidedly inferior, but this is on account of the worthless trees that were first planted. It is only the imported trees that are producing first-class fruit, and of these the following varieties are superior to our common oranges, and would pay to be largely worked in this Colony, as the quality of our oranges as seen on our markets is getting year by year steadily worse, so that it is now a difficult matter to get a case of really fine fruit, viz.:—"Washington Navel;" this is an entirely distinct orange from the common navel. "Mediterranean Sweet"; a small tree, of drooping habit, nearly thornless; a prolific and early bearer of high-class fruit. "Azorean St. Michael," a large tree, moderately thorny: first-class fruit. "Homosassa," the favourite Florida orange; tree very thorny, good grower; fruit nearly seedless, and very heavy. "Paper Rind St. Michaels," a round, very heavy fruit, of medium size, having a very thin skin; quality very good. In addition to the prize mentioned there were a number of prizes for different varieties, and in some the competition was very keen. In these

New South Wales was rather more successful, though not with Cumberland fruit. However, Miss Holding, of Wentworth, showed some very fine fruit, and saved the reputation of the Colony. Of lemons there was a very good display, with the exception of one sample, all being partly cured fruit. In mandarins and bitter oranges Queensland had it all her own way. The seedling Mandarin, shown by Mr. W. H. Parker, of Glen Retreat, Brisbane, was superior to any Mandarin that I had previously seen, and a distinct acquisition to our list of first-quality fruits.

A fine collection of apples was also exhibited by Mr. J. R. Warren, of Harcourt, Victoria. Amongst the fruits exhibited by the Queensland Delegates, but which were not for competition, were some very fine pine-apples of the Ripley's Queen and smooth-leaved Cayenne varieties, some especially good papaws, and some small though highly-flavoured custard apples. Specimens of the Monstera Deliciosa and Carambola plums, as well as of our native limes and oranges were also shown, and the collection of economic plants contained some very fine specimens of sugar-cane and arrowroot, as well as a large number of other plants and products. One thing about the Queensland exhibit greatly in its favour was that it was well staged, and every exhibit was distinctly labelled with its common and scientific name, as well as the grower's name and the district where grown. This distinct labelling of the exhibits is a point that is often greatly neglected in our local shows, and very wrongly so, as when the exhibits are clearly and correctly labelled, their educational value is very greatly increased.

It is interesting to note that the whole of the Queensland fruits were packed in tea-tree bark, which proved to be an excellent packing material, as all the fruit carried well, and arrived in good condition. The test was a severe one, as some of the fruit had been gathered for over a month, and many of the fruits shown are naturally tender and hard to ship. The journey was also a hard one on the fruit, as it had to be transhipped several times, and every handling tends to bruise the fruit more or less, so that the packing material used must be considered a great success.

In addition to judging the fresh fruits, I, in conjunction with Mr. Allen, the Manager of the Mildura Planters' Union, judged the dried fruits, and here in several of the classes the competition was very keen, and the exhibits of especial merit.

In dried apricots, which are Mildura's specialty, some very fine fruit was shown, which would have no difficulty in finding a ready sale at good prices in any market. The fruit was of large size, fine colour, good texture, well cured, and very free from grit, which is often so noticeable in sun-dried fruit. Some fine samples of dried peaches were shown: two samples of Alberta, one peeled and one unpeeled, being of especial merit. A good sample of dried nectarines was also shown, and there were also samples of dried figs, pears, and quinces, none of which, however, were of especial merit; one sample of figs, "White Adriatics," was, however, fair, but the sample was uneven, some being well cured, and others very indifferently. It is probable, however, that, with the experience gained by drying last year's crop, that there will be a better result from the present crop.

There were a number of raisins shown, some of which, both layers and lexias, were very good, the berries being large and meaty, the skins as a rule fairly tender, but the stones were heavy. This latter fault will probably disappear as the vines grow older, as the raisins from young vines have always large stones.

An exceedingly good sample of currants was shown, the fruit being of good size, very even, of good colour, and remarkably clear, and free from

dust, altogether a very superior sample to the currants of our stores. Some good samples of sultanas were also exhibited, the fruit being quite equal to anything imported, thus proving conclusively that as far as raisins, currants, and sultanas are concerned, there should be no occasion to import any into this Colony, as what has been done at Mildura can be done quite as well in many of the drier parts of New South Wales.

Before leaving the dried fruits I must say a few words about a small box of crystallised fruits, consisting of plums, pears, comquats, apricots, and green almonds, that were exhibited, and which were prepared by a Mildura lady. The fruits were equal to any of the crystallised French fruits, and the process of manufacture was evidently similar. The fruit was exceedingly well got up, and would, I am sure, find a ready sale anywhere. The fair was very well managed, the exhibits being staged and arranged so as to produce the best effect, and to show off to the best advantage, and the whole of the decorations and trophies were arranged with great taste. The fair was a credit to Mildura, and I am sure was a revelation to most of the delegates. I cannot give too great praise to the indefatigable energy of the secretary, Mr. W. H. Taylour, and of the stewards, as the fair was a decided success, no trouble being spared to make it as attractive as possible in every way.

Having now given a short account of some of the productions of Mildura, and their method of exhibiting them, I will give a few of my impressions of the fruit-growing capabilities of Mildura, and of the work that has been and is being done there—dealing more particularly with the methods of cultivation and irrigation adopted, and of the drying and handling of the fruits when grown.

In the first place we have to consider the suitability of Mildura for an irrigation colony especially adapted for fruit culture, and of this suitability there is not the slightest question, as the great essentials to success are all present, the greatest drawback to the settlement being its distance from a market. This difficulty will be in a great measure overcome when there is a railway, the building of which is only a matter of time, as it is bound to go to Mildura sooner or later. The great essentials to success are climate, and the mildness of the winter and the long dry summer. The abundant sunshine and very dry air of Mildura, are just what are needed to produce a good-drying fruit, and also to dry it when grown; and when combined with judicious irrigation, to produce a high-class orange or lemon.

The second essential is the suitability of the soil for irrigation and fruit culture, and it is of the greatest importance to the ultimate success of the settlement to get the right kind of soil—in fact, it is a much more important point than most persons are led to think, the common idea being, that no matter what kind of soil you irrigate, it will be much the same and produce good crops. This is, however, a very great mistake, as no land is suitable for irrigation on a large scale unless it possesses perfect natural drainage, and the only soils that possess this quality are sandy loams of light or medium texture, of good depth, and having a porous subsoil to allow a free get-away for superfluous water; all soils having a clay subsoil or a hard-pan within a short distance of the surface are unsuited for irrigation unless they are first well sub-drained. The soils of Mildura are, as a rule, well suited for irrigating, as they are of the right consistency and possess the necessary drainage. The soil, which varies somewhat in colour and texture, varies from a light sandy loam to a good red loam of medium or light medium texture, is easy to work, and retains moisture well when properly cultivated. In places there is a large amount of limestone grit or small nodules in the soil, and the whole of the soils that I saw were rich in

lime, which is a good general indication of the suitability of the soil for vines. Some of the soil, though not of especial richness, is, nevertheless, well adapted for fruit culture, as, though possibly deficient in some plant foods if it were only a few inches deep, yet with the good depth of soil that is generally found, there is ample mineral plant food for the successful growth of fruit-trees and vines for years to come. Probably the greatest deficiency in the soil is organic matter or nitrogen, and where this is deficient the growth of peas, green corn, or cow peas, to be ploughed in as a green crop for manure would, probably, have a very beneficial effect.

The third, and most important, consideration is the supply of water, and of this I am not able to speak with authority; but, as far as I could learn, there is never likely to be any anxiety about not having enough water, as, even though the river should fall so low during a prolonged drought as not to be able to supply the necessary water, provision has been made to store a supply of water by locking at both ends a large billabong of the Murray that runs for some 10 miles through the settlement, and which is always kept full. The supply thus kept as a stand-by is said to be sufficient to meet the requirements of the whole Colony for a period of three months, so that there should not be the slightest fear of the settlement ever having a water famine.

The method of irrigation adopted is by means of furrows, the water being brought to the highest portion of each lot of 10 acres, and thence distributed in furrows by gravitation. This is the simplest, best, and most satisfactory way of irrigating an orchard or vineyard, as the water is thus easily distributed through the soil, and not confined to the ground immediately surrounding the trees as is the case where a basin is made round the tree, and which will also have the effect of confining the tree roots to the area of the land watered. After the orchard or vineyard has been irrigated, and as soon as the land will carry a horse without injury, it is cultivated, two horse cultivators which stir the land, not turn it, being used. This is to prevent the land caking and forming a crust, and the result is that the water is retained in the soil for the use of the tree or vine, and not lost by evaporation. In many instances far too much water has been used and too little cultivation done; the greatest success is obtained by using as little water as you can and by the constant and thorough use of the cultivator. The evil effects of over irrigation are shown by the rise of the alkali in places, and in others by the production of too much wood, and little (if any) fruit, but that of a large size, though very watery, and which dries badly. The effects of over irrigation are very apparent along many of the channels used for the conveyance of the water. The land adjacent to the channels has become saturated by water that has seeped from the channels. This water in passing through the soil has dissolved a large proportion of the soluble salts contained in the soil, and the water containing these salts in solution—when it rises by capillary attraction, which is greatly accelerated by the great sun-heat—on evaporating from the surface leaves a deposit of soluble salts behind, giving the land the appearance of being covered in places with a heavy dressing of common salt. Where these salts or alkali, as they are termed, are present in excess, the soil is rendered valueless and unsuitable for growing fruit, as the excess of alkali soon destroys any trees or vines that are planted in the soil. The causes of this seepage are two—first, the undermining of the channels by cray-fish, which bore through the bed of the channel, and allow the water to escape; and secondly, the subsidiary channels have not, in my opinion, a sufficient fall, as though the main channels may run water well with a fall of only 6 inches

to the mile, the smaller distributing channels require a considerably greater fall than this to carry water without undue loss from seepage. There are two ways by which this damage caused by excessive seepage can be counteracted. One is by cementing all the distributing channels, which will involve a very large expenditure, and the other is by sub-draining, as the sub-drains will carry off the excess of soluble salts in the soil. Where sub-drainage is employed, of course it will be necessary to provide an outlet for the drains, as the water containing the alkaline salts in solution must be got away if possible to the river. By sub-drainage combined with irrigation, the most alkaline soils can in time be completely leached of their excess of alkali, and become available for cultivation. The alkali of Mildura is a white salt, probably a mixture of common salt—sulphate of soda and sulphate of magnesia—but I did not see any indications of black alkali caused by the presence of an excess of carbonate of soda. I have mentioned this matter of seepage and alkali rather fully, as it is a matter that has given, and is giving, the people of Mildura a great deal of trouble, and has occasioned a considerable amount of loss, as should any irrigation colonies or large irrigation schemes be started in New South Wales it is the one great thing that should be guarded against, and the experience of Mildura should be of the greatest value to us. Mildura is by no means a dead level country, the land being gently rolling, thus giving the necessary fall for the distribution of the water by means of furrows, and if sub-drainage becomes necessary, will provide a get-away for the water. The methods of cultivation adopted at Mildura are as follow:—The land is first cleared of mallee and other trees by means of a powerful traction engine, and a strong steel cable, which is wound on a large drum attached to the engine. The wire cable is made fast round the mallee clumps, and the engine does the rest. After clearing, the land is cultivated with a very heavy powerful steam cultivator, which is drawn by means of strong steel cables attached to two powerful traction engines similar to those used for steam-ploughing, and when finished one way it is cross-cultivated, the whole ground being thoroughly loosened to a depth of 18 to 20 inches, and any roots or stumps left in the soil are completely torn up. The land is next graded or levelled, so that the water used for irrigation may be distributed evenly, and with as little trouble as possible. When graded the land is ready for planting, the planting being done in a similar manner to that commonly employed elsewhere. After planting, the cultivation of the orchard consists in keeping the soil well stirred by means of a one or two horse cultivator during the spring, summer, and autumn months, and by ploughing once or twice during the winter, taking care when ploughing not to ridge the land, but to keep it as level as possible. The ploughs I noted being used were the one-horse Oliver chilled ploughs, but where there is at all a large area of land to deal with, as at Lord Ranfurly's, three or four gang light orchard-ploughs should be used, as they do the work equally well, and are a great saving of time and labour. At Mildura the trees are, as a rule, pruned, and pruned hard, the difference between their deciduous fruit-trees and those commonly met with in New South Wales being very marked. The Mildura trees are strong and compact, the fruit-spurs being all along the main branches, and the bulk of the fruit within easy distance of the ground. There was a very good show for fruit, the apricots especially being one mass of fruit-buds. All fruit-trees are kept healthy and free from pests, as for as possible, in all the best orchards, the growers realising the necessity for keeping their orchards free from pests if they wish to grow good fruit and make a success of their business. The vineyards are, as a rule, not kept in as good order as the

orchards, the vines in many cases being badly neglected, and the pruning is, as a rule, very deficient. The growers have generally been too greedy and anxious to get quick returns, consequently the shape of the vines has greatly suffered, and in a few years many of the vineyards will, if not taken in hand at once and put into proper shape, get played out and want renewing. The vines are all headed very low, and the vines (raisin grapes) are all allowed to grow on or near the ground, after the Californian method, as this style is found to produce the best raisins.

One thing that was very noticeable after being accustomed to the lemon orchards of Cumberland, was the absence of any fruit, other than an odd one, on any of the trees. All had been cut, not pulled—the first cutting taking place on 10th May, and all the fruit was stored and undergoing the process of curing. The trees were thus having a rest, and the fruit will be put on the market when it is worth the most money. The process of curing is similar to that published by this Department some two years ago, and I beg to refer anyone wanting the information to the article that then appeared in the *Agricultural Gazette.**

The process of drying employed at Mildura is entirely that of sun-drying, the extraordinary dryness of the air and absence of rain during the drying season rendering it a comparatively easy and rapid method. Apricots are gathered when fully ripe, but yet not so ripe as to be mushy, then cut in half to remove the pit, the cut halves placed on trays with the cut side up, and then sulphured, the sulphuring being only sufficient to fix the colour. The fruit on the trays is next placed in the sun, a large lucerne paddock of 100 acres in extent being kept as a drying-ground. The lucerne is cut short, the trays resting on the stubble, so that there is no fear of the fruit being roasted on the trays the same as if they were placed on the bare ground; and another great difficulty of sun-drying, namely, dust, is also in a great measure prevented. When sufficiently dry, which is usually in from three to four days, the fruit is placed direct into canvas sacks, where it is allowed to remain for some time, being taken out when required and packed. No sweating the fruit is done. Raisins are either dipped or not, the dipped raisins, or Lexias, being used for cooking, and the undipped layer raisins for dessert. Dipped raisins are always stemmed, but the layer raisins are packed with the stems on.

The raisins for layers are cut and handled very carefully, so as not to destroy the bloom on the fruit, and when sufficiently dry, which is usually in from ten days to a fortnight, they are placed in the sweat-box and allowed to remain there till the whole sample is of an even texture, when they are packed. Lexias are dipped as soon as gathered, the dipping removing the bloom, slightly cracking the skin, and causing the fruit to dry more rapidly than undipped fruit. Currants and sultanas are treated in a similar manner to raisins and peaches, and nectarines are treated the same as apricots.

The fruit is well handled at Mildura, and the Planters' Union, a co-operative association, of which Mr. W. J. Allen is manager, have a very well fitted-up packing-house close to the wharves on the Murray. The packing-house is built in the side of a hill, so that the ground is on a level with an upper floor, and carts containing dried fruits, say raisins, can leave the fruit so that it will go through the stemmer and grader and down to the packing tables in the main sheds without handling, and when packed the fruit can be run across to the river steamer and loaded, thus saving a large amount of handling, and enabling a great quantity of fruit to be handled at

* Vol. III, p. 666.

a very moderate expense. Mr. Allen is a thoroughly practical man, well up in every branch of his business, and the settlement has been very fortunate in having him, as the success of their dry fruits is in a great measure due to his care in curing and packing. The Planters' Union, worked on co-operative principles, is a financial success, the fruit being handled cheaper and better than it could possibly be by individual growers, and the fruit being all carefully graded, it is possible to maintain a given standard for each grade. This co-operation amongst growers to dispose of their produce is what we so much lack in this Colony, and it is the essential I mentioned at the commencement of this article that is so urgently needed to place the fruit-growing industry on a sound basis.

One of the greatest drawbacks that the original settlers of Mildura have had to contend with has been the large numbers of utterly worthless trees of all varieties that were first planted out. These trees, the scourings out of all the nurseries in the colonies, and the greatest lot of rubbish that was probably ever brought together, have now to be weeded out, or worked out with suitable varieties, and many men who bought these trees in the belief that when the trees came into bearing they would have a good paying orchard, now find that they have a lot of trees that are not of the slightest use to them, as the fruit is of no quality whatever, and utterly valueless to them. Now they have things on a much better basis, and several reliable nurserymen have nurseries at Mildura, and are supplying trees suitable to the district, and which will grow fruit that will be readily saleable. Another drawback is the absence of shelter, and it is needless to say that a good shelter is of the first importance, as a protection from the burning winds of summer, which cause a premature ripening of all deciduous fruit, as well as being of the greatest value to citrus fruits at all times. Almond trees have been planted round a number of blocks, and will form a partial shelter for deciduous fruits, but what are wanted are belts of shelter trees, such as Sugar Gums or Blue Gums, of considerable extent, to act as general windbreaks, and the loss of land occasioned by planting these belts will be more than compensated for by the protection provided. Shelter trees make a very rapid growth at Mildura, the Pepper-tree being especially noticeable—the soil, climate, and irrigation appearing to suit it exactly. Olives have in some cases been planted for shelter, and the rapid growth that they make at Mildura soon enables them to form a very fair shelter, besides the fruit, as in the case of the almonds, will pay for the ground they take up and the cultivation and irrigation they receive. In conclusion, just a few words about the fruit-growers of Mildura. Who are they? Well, as a rule, they are a well educated, intelligent class of men, who have had no previous knowledge of fruit-growing, and, consequently, are not tied down by any old-fashioned or pre-conceived notions, but are ready to do as they are advised by men who are well up in progressive fruit-growing; and they are fully alive to the necessity of keeping up with the times, and of growing nothing but first-class fruits. During my visit to Mildura I was treated with every kindness, and I am sure I am only endorsing the opinion of every delegate who was present at the Conference when I say that the people of Mildura spared no trouble or expense to make the Convention and Fair a success, and to make our stay, whilst at Mildura, as pleasant as they possibly could.

Winter Food for Dairy Cows.

By J. L. THOMPSON,
Principal, Hawkesbury Agricultural College.

The severity of the past winter in many parts of the Colony, the partial drought in the coastal districts, and the consequent scarcity of food for milch cows, should be a warning to dairy farmers to make better provision for their stock in the future. I have travelled a good deal recently in the New England and other districts, and was simply astounded that little or no provision was made to tide over the severe winter in that and other parts of the Colony.

There are many kinds of food which could be grown with advantage for winter feeding, but my object in penning this brief article is to again draw special attention to the claims of silage as a most suitable and economical food, particularly for milch cows, as it greatly encourages milk production. It is well known that rape, cabbages, turnips, lucerne, &c., taint the milk to a greater or less degree, but it has never been proved that silage, used as food for milch cows, has ever tainted or impaired the quality of the milk in any way; but, on the contrary, the very best milking results have been obtained from the use of good sound silage. I am aware that in certain quarters silage has been blamed for imparting a disagreeable flavour to milk. On strict inquiry, however, it has been found that the taint is caused by contamination, the silage pit being too near the dairy. In some cases the taint was caused by milkers feeding the silage to cows and milking without washing their hands. A great deal of literature has appeared in this Colony on the subject of silos and ensilage. The Government offered handsome prizes three years in succession for the best methods of preserving fodder in a succulent condition by means of a silo or stack, of which I was appointed to be sole judge, but it cannot be said that the system has taken hold of the people of this Colony to any extent.

Although excellent fodder has been preserved in stacks, and also in holes simply dug in the ground, I am strongly of opinion that, for dairy stock at all events, the silo is by far the best and most economical method, as the fodder can be chaffed, a really great advantage when maize, sorghum, or other strong fodder plants are dealt with.

The shape of silos in America and Great Britain has been somewhat modified during recent years. The smallest percentage of waste occurs in deep silos. There are now some silos in the United States 24, 30, and even 36 feet deep. It has recently been found that silos in which the length and breadth are equal are more economical than such as are long and narrow.

Feeding from the entire upper surface is now considered the proper method, and if 2 or 3 inches of silage are fed out daily over the whole surface there will be no waste from it becoming mouldy. A cubic foot of silage,

if well pressed, will weigh about 56 lb., and will be ample, with a little concentrated food, for the daily ration of a cow in full milk.

Although some people are of an opinion that silage can be made without pressure, I hold an entirely opposite view. I am still of the opinion expressed by me years ago—and consistently held up to the present time—that the system of ensilaging fodder of all kinds has only to be better known to be fully appreciated by every stock-owner in New South Wales, and am more and more surprised that it has been so much neglected in our Colony, where, perhaps, of all places in the world, it would be of immense benefit to everybody concerned. The adoption of ensilaging fodder only means that ordinary prudence and sagacity have been observed in making use of a most economical and effective system of conserving food for domestic animals.

It has certainly many advantages over the old practice of curing by desiccation. Not only maize, but all descriptions of green fodder, can be most economically saved in a perfectly succulent condition. No system of providing fodder for stock can be more certain than that of the silo or ensilage stack. Safe against fire, made with a minimum of loss, silage provides a supply at all times of useful food.

By cutting all cereals when in blossom, the ground is cleared of weeds. An ensilage crop can be removed from the field one day, the land ploughed again, and another crop sown the next. On good land an early-sown crop of barley, vetches, &c., will be ready for the silo in October; the land can then be ploughed and planted with maize, which will be fit for the silo about February or March. This plan of operations is very successfully and regularly carried out on our own farm.

It may be valuable to produce some testimony as to

The Value of Silage.

A good deal has been written as to the value of silage, and in some instances its importance has been over-estimated.

A circular was recently issued by the Department of Agriculture of U.S.A. to 4,000 farmers, asking them to report on the value of silage. Not one said a word against it.

The following are some of the replies:—

1. "It will double the stock-carrying capacity of our farms."
2. "It gives a vigour and healthy appearance not seen in hay-fed cattle." "We can double the stock, thus increase the fertility and value of our farms."
3. "It enables one with a little land to keep a large amount of stock."
4. "We believe stock can be kept for one-half the cost of other food, and will fatten as well as during the best grass season."
5. "Anything of vegetable nature that animals will eat will make useful ensilage."
6. "Forty or 50 tons of fodder can be ensilaged off 1 acre, which is worth more than 20 tons of hay."
7. "The cost of feeding on ensilage as against hay and roots, is 1 to 3."
8. "I think cattle can be kept for one-fourth the expense of any other method."
9. "One acre of ensilage will keep eight head of cattle 100 days."
10. "I am keeping four times the number of stock with my silos than I have been able to do hitherto. A silo filled with green fodder in time of protracted drought is invaluable."

11. "The profits are very large."
12. "Silage I believe to be the dairyman's anchor, especially on expensive land. I would as soon think of doing without a house as without a silo. I farm for profit, not for pleasure, and have found the silo the best investment I ever made."

Mr. Walter Madden of Victoria, ex-Minister of Lands, and brother of Sir James Madden, the Chief Justice of Victoria, says: "The same 50 acres of green stuff that would produce 100 tons of hay at a cost of about £1 per ton for the making, would produce 300 tons of silage at 2s. per ton for the making, and the 300 tons of silage when made would be worth at least double the amount per ton than the hay would be worth, either for fattening or milk production, and worth many times as much as a summer fodder for cows. A cow cannot eat more of the silage than of hay in a day."

A Victorian farmer writing to the press says: "Hay is not to be mentioned in the same breath as silage. I think 1 ton of silage is worth 3 tons of hay for milk producing. Horses are also very fond of it. I am going to make another silo, and convert all my crop into silage."

Mr. David Wilson, another Victorian:—"I made a silo, and filled it with green wheat and oats, and 10 acres of Scotch thistles, all chaffed. It was a complete success, the cattle eating it well. Butter made from it secured 1st and 2nd prizes at the local show."

"Freehold" writes in the *Australasian*:—"The fact that silage is good, and the conclusion that it would be specially valuable during the dry Australian summer, need be no longer disputed. It is a fact that in stack silage the loss is only trifling as compared with the gain in the cost of procuring the cured fodder; moreover, it is found that stacking in sheaves is a very convenient method, the reaper and binder being brought into requisition."

A writer in the *Argus* says: "Some years ago Mr. A. Dunlop, a well-known cheese-maker, was living on the Harewood Estate, near Tooradin. About that time he pitted some green maize for silage. Several months later he found it had rotted on top, and thinking the whole spoiled, left it undisturbed. Mr. Dunlop having left, Mr. F. Greaves took over the farm, and recently found, on examining the silage, that although 1 foot on top had rotted away, the remainder was in perfect condition, showing that the method is valuable for storing the surplus of good seasons, even for years, thus providing a valuable reserve to fall back upon in times of scarcity.

Mr. Alexr. Crawford, in 1889 manager of the Victorian Government Travelling Dairy, in a lecture on this subject, says: "To give you some idea of the comparative value of hay and silage, take one instance. Ten tons of green fodder equal 3 tons of hay, and 10 tons of green fodder will make within a fraction of 10 tons of silage. Few beasts will eat more than 56 lb. of hay per day, and they will eat about the same weight of silage; thus the hay would feed one beast for 120 days, and the silage for 400 days; and during that time the silage beast will milk better than the hay-fed one."

Mr. M. Burke, of Woodstock, Victoria, speaking of the immense value of silage, says: "Some years ago I ran my milch cows—about 150 head—on 1,600 acres of grass land; recently I have only used 600 acres, but have grown silage crops, and I find that I can keep as many cows, and in better milking condition, on the 600 acres, with the use of silage, than I formerly did on my 1,600 without it; and if silage had not come under my notice I certainly could not have continued to go on dairying profitably.

Mr. James Bell, of South Australia, says, in a lecture on the subject, after detailing the proceedings necessary in providing silos and silage: "The result of all the outlay has been thus: The milk produced by silage is richer in cream, butter is sweeter and of a better colour, and the cost of feeding on silage is about one-half as compared with bran and chaff. Bear in mind I am not telling you what can be done, but what I *have* done, and what the result has been. Twenty tons of silage would go as far as 20 tons of hay. If 20 tons of green stuff be dried, we only get 6 or 7 tons of hay.

There are also other advantages arising from the use of silage. When in a pit it is safe from fire and flood; in the stack it is safe from fire. The harvesting is done early, when labour is most easily obtainable, and the land can be early ploughed and scarified and exposed to the summer sun.

In June, 1891, I wrote to the local paper pointing out the value of the system for this district, and where, during the year mentioned, much inferior hay was made, or perhaps I ought to say good hay spoilt owing to almost continuous wet. The haymaker can make hay only when the sun shines; the silage maker can harvest the crop in any kind of weather, even in heavy rain; and if this crop is rather old the silage will be all the better for the wet.

The spotted or variegated thistle makes capital silage. Of it, Mr. Featherstonhaugh, of Goorianawa, writes, that three stacks of about 890 tons in all, obtained from 10 acres, were completed at a cost of about £110. Stock eat it greedily; 8 lb. per day will keep a sheep alive and in good heart. There is an exceptionally large amount of mineral matter in this plant, much of it salt, a point considerably enhancing its value.

Silage is a subject of a special report by the Victorian dairy expert, Mr. Wilson.

He says, amongst other things, "That at present many butter factories and creameries have to be closed for four months in the year simply because there is no food for the cattle. Silage would supply the food required at a time when the market price of dairy produce is at its best. We have to import butter from New Zealand. Plentiful supplies of good silage would obviate this, and, in addition, would reduce the evil consequences of a drought."

The Board of Agriculture in Great Britain, in one of its leaflets published in 1898, refers to the great value of silage both in respect to being able to save wholesome food for stock during periods of excessive wet and also for tiding over periods of drought.

It has been pointed out that silage is, as a form of food, in a better condition for digesting than hay. The latter is dry, and, after being eaten, must be considerably softened ere its nutrition can be useful. Silage, on the contrary, is soft and saturated with moisture, so that it is easily masticated, and the process of digestion and assimilation can commence at once, and before it has passed through the stomach most of its available nutriment has been assimilated.

In practice, says one writer, it is found that a crop of fodder of any kind converted into silage, will support three times as many animals as the same crop would do if made into hay, and five times as many if they were turned out to graze upon the crop.

One great advantage in connection with making a crop into silage is that there is practically no waste, whereas in turning it into hay much loss occurs owing to frequent handling, as the leaves and stems becoming brittle, break, and many particles fall away.

It may not be generally known, as pointed out by Dr. A. P. Aitkin, that Bracken fern, so common in some hill districts as to be positively detrimental to the grass, is remarkably well adapted for silage, possessing a very high percentage of nitrogenous matter, in which respect it compares favourably with silage made from clovers. Sheep eat it greedily and thrive on it. The all-important matter in making bracken silage is that the plant must be cut young, before the curl is off the leaf. The plant being no use for silage if cutting is delayed until the fronds have expanded, as they have then become hard and leathery. One other point, a high temperature, must be attained in the stack to make good bracken silage.

It is, I think, needless to say more on this aspect of the question. There is undoubtedly a general consensus of opinion with regard to silage to the effect that it is a most valuable form of food for stock, and is indispensable in a country situated like our own, where seasons vary so much, and in consequence the stock of available grass fluctuates considerably, whilst its preference to dry food for milch cows is beyond question.

Ensilage at the Hawkesbury Agricultural College.

In 1892, during February, we built about 8 tons of green maize (broadcast sown) into a small stack, applying weight by using some spare posts and rails. When opened in July, it was found to be in a perfect state of preservation, the cows eating it with avidity improving very considerably in their milk supply.

During November we put together a stack of about 90 tons, made up of green wheat, oats, barley, and vetches, pressure being applied by means of Johnson's Patent Ensilage Press, of 100 tons capacity, obtained at a cost of £33. The apparatus consists of seven pairs of drums, each fitted with ratchet and pawl fixed exactly opposite each other on strong timbers. Steel-

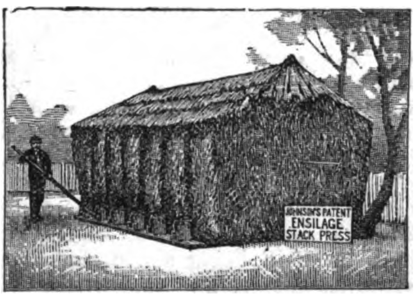


Fig. 1.—Johnson's Stack Press.

wire ropes pass over the stack, attached each to a separate pair of drums. Levers are applied on both sides of the stack, each rope being tightened at both ends simultaneously. The levers can, of course, be readily moved from one drum to another, or to other stacks if required. The silage turned out in splendid condition, and was much appreciated by our stock.

In 1893, during May, a temporary pit was excavated in a piece of rising ground in one of the paddocks, with scoop and bullocks. Over 100 tons of white ensilage corn and sorghum were carted into this pit, the drays being driven over the mass with each load, so as to consolidate it. The earth was

used for weighing and covering the silage, and was brought to a fine peak to throw off the rain. The pit was opened in August, and the silage found to be in splendid condition, and was of great service to our milch cows during the winter months, the only drawback being that it was not chaffed.

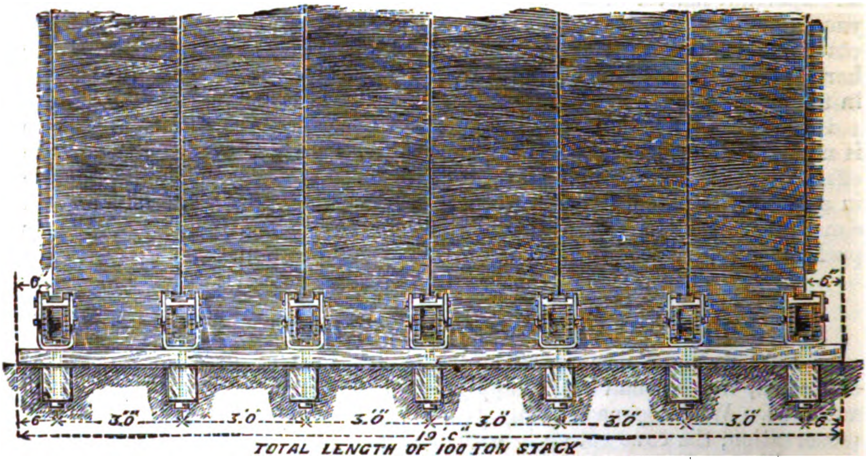


Fig. 2.—Johnson's Ratchet and Pawl.

Early in 1894 a properly constructed silo was authorised, and this has now been completed in a highly substantial and satisfactory manner.

Description of College Silo.

The site chosen was on ground with a grade of 1 in 60 feet. Before excavating for pit a drain was laid with agricultural 6-in. drain-pipes, at an average depth of 6 ft. 6 in., the pipes covered over with loose boulder-stones within 2 feet of the surface, to prevent soakage of water into the silo.

The silo was then excavated to a depth of 10 ft. 6 in., the bottom being good stiff clay. All the clay taken from the pit was used in puddling behind the walls, and a portion of the earth for banking up the sides above ground 4 ft. 6 in. high x 9 ft. on the base. The size of the silo, as finished, is 40 ft. x 12 ft. x 15 ft. deep, 4 ft. 6 in. being above the ground, the pit being divided into two equal compartments. The whole of the walls and supports for roof are of sawn ironbark strongly framed together and covered with a semicircular roof, projecting at each end over silo pit about 20 feet, affording ample covering for drays when loading. The roof is constructed of pine rafters, built on three thicknesses and filled in with purlins to take curved corrugated iron. The eaves are provided with 6-in. half round guttering, to conduct roof water to drains at lower end of silo. Under the crown of roof is fitted up Myer's Patent Reversible Carrier on steel track, for loading silage and carrying it outside the silo, so that it can be dropped into a dray. This is a very great convenience and labour-saving appliance. The walls are constructed with 9 in. x 9 in. corner and 6 in. x 6 in. intermediate post, each set into concrete blocks, and secured at 8 feet from bottom to 12 inches diameter, log sills running out 12 feet long, into which is morticed

and spiked the upright to take wall-plate of roof, also stay to which both uprights are bolted, thus affording ample resistance to pressure from either side. Into wall uprights are framed 6 in. x 3 in. rails, to which is spiked the upright wall-planking of 6 in. x 2½ in., square-jointed, grooved on both edges, ½ in. x ½ in., forming in each joint grooves 1 in. x ½ in., down which any soakage that may reach the walls will pass to the bottom. Round the whole of the walls about 12 in. thick of clay puddle is filled in against the planks. At each outer end an opening is provided, filled in with movable horizontal planks to lift out when cutting out silage. Loose planking, 3-in. thick, covers the top, on which mechanical pressure is provided by means of a system patented by myself in conjunction with Mr. James Simpson, of Egerton, Victoria. It consists of ⅝-in. chains, anchored at the

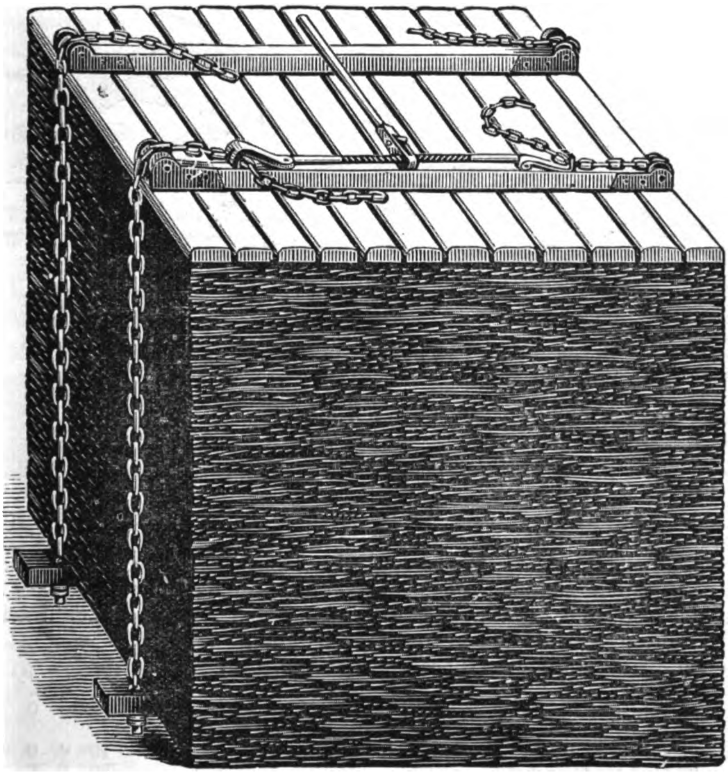


Fig. 3.—Thompson and Simpson's Patent Screw and Ratchet Press.

bottom of the silo, opposite to each other. While the silo is being filled the ends of the chains are thrown over the walls. After the silo is full the planks are placed across the short way of the silo; on top of this a traverse beam, 10 in. x 6 in., is laid, stretching from end to end of the silo. On the ends of the beams brackets are fixed to carry movable rollers, over which the chains from either end are placed. A large double screw, similar to a railway coupling, is hooked into the ends of the chain, and by turning a lever

the ends of the chain are drawn closer together, causing the beam and covering of the silo to sink and press the fodder. A double pin, resembling a staple made of steel, catches the chain and holds the beam down; the screw can then be made to take a fresh hold, or be removed altogether to another silo. Any number of beams may be used, according to the size of the silo and the pressure required. We have two beams in each of our silos, which average 20 feet long, 12 feet wide, and 15 feet deep. Only one man must apply the screw ratchet, the leverage being so great that some-

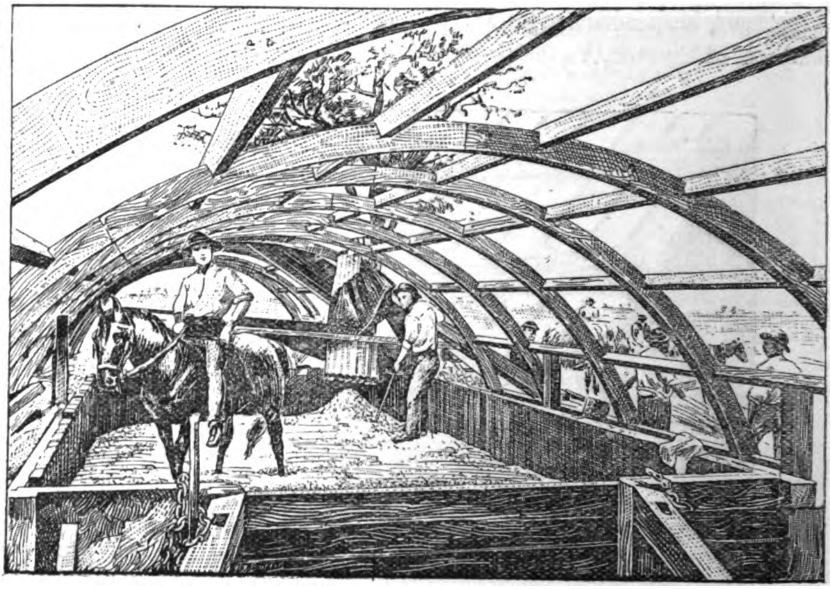


Fig. 4.

thing is bound to go if greater strength be applied. It is computed that the leverage of the appliance is equal to 450 to 1. It is only justice to T. W. Reynolds & Co. to state that the system adopted here is a modification of their invention, but altered in some important particulars.

The following is the actual cost of the above:—

	£	s.	d.
Excavating, laying pipes, filling-in and covering drain ...	9	15	0
Excavating silo pit; also trenches and holes for timbers and puddling, and banking round walls	19	4	0
Timber for the whole	89	3	6
Iron, including galvanised and wrought	43	16	6
Labour of erecting, carpenters and plumbers	41	15	0
240 feet of ⅝-in. cable chain	7	1	10
Fittings for pressing	15	11	3
2 cubic yards concrete	2	0	0
Cartage, &c.	12	13	6
	£241	0	7

Although the cost £240, in round figures, appears at first sight rather high, it must be remembered that the structure is very substantial and complete, and, bar accident, will last a lifetime. Being a permanent

improvement, the expenditure should be looked upon from that standpoint. Say money is worth 6 per cent, per annum, the yearly interest on the cost would be £14 8s. Now, the question may be fairly asked, is the silo worth that amount to a dairyman with eighty cows, or is it not? I venture to state that it is worth many times that amount.

The capacity of the above silo is 7,200 cubic feet, which when full and thoroughly pressed will turn out from 150 to 175 tons of silage.

A simple elevator was constructed to carry the cut sorghum over the wall and, by means of a shoot, it was deposited near the centre of the silo.

The filling of the silo commenced on 17th May, finishing on 1st June, the work being suspended for a week during that time; the actual time taken to fill it was nine days. The students took great interest in the proceedings, as also did our neighbours and townspeople. A crop of sorghum had been put in for the purpose during January; it comprised 25 acres, and yielded 7 tons to the acre.

Owing to the silo not being completed in time, the sorghum was rather over-ripe and not so succulent as it should have been; nevertheless, it turned out fairly well.

The following was the process carried out:—

2 men and students cutting the sorghum in the field; laying it down in armfuls.
3 students with 2 drays and trolly, carting in to the chaffcutter.
1 man loading in the field.
1 student driving engine.
1 man feeding chaffcutter.
1 student levelling in pit and 1 treading down the cut silage with a horse.

An 8 h.-p. portable engine (usually employed to drive the sawmill) was put in position to work the chaffcutter, one of Hudson Bros.' No. 2. One of the pits was opened on 13th August, and the silage has been in constant use ever since, a few inches being taken off the surface daily, and fed to our milch cows, which have improved considerably in their appearance and milk production since they commenced with it.

The Live Stock and Meat Trade of The United States of America.

By ALEX. BRUCE,
Chief Inspector of Stock.

Report No. I.

Introductory Statement.

When I left the Colony for America it was understood that a considerable portion of my time would be devoted to visiting those parts of the United States where it was likely I would be able to obtain information that would be of service to our pastoralists or farmers; but on arriving at Chicago I had to devote my attention to the arrangement and dsplay of our exhibits of wool, and by the time these were completed, arrangements were made for their examination by the judges.

This occupied fully two months, and it was the beginning of October before I was able to leave the Exhibition. I then made a hurried journey to Los Angelos, in Southern California, to see something of the nature of the country on the route, and attend an Irrigation Conference held in that city, at which delegates from all the Western and some of the Central States of the Union were present, as also representatives of several of the other countries attending the World's Fair. The principal business of the meeting was to ascertain the position of existing water rights in the United States, and collect materials for legislation.

After considerable discussion the resolution arrived at was that all water should be placed under the control of the Government, to be fairly apportioned under Trusts to the individual owners entitled to its use.

Very large tracts of land in Southern California are irrigated, and fresh areas of considerable extent are being constantly laid out, while water is brought very long distances from the mountains at heavy expense, and in every instance, so far as I could learn, it was laid on by gravitation. In several cases the supply was considerably increased by the flow from artesian bores.

The delegates, after the business of the meeting was concluded, were kindly shown over the famous orange and stone-fruit orchards and vineyards at Riverside, San Joseph, Los Angelos, Antonio, San Bernardino, The Perris, Alessandro, San Diego, and Santa Barbarra, which are all admirably laid out as regards levelling, service of water, and convenience for thorough irrigation, and are kept in the highest state of cultivation. As regards the excellent quality of the fruit grown in California, I need here say but little, as that has been dealt with in the Executive Commissioners' report on the fruit

exhibited at Chicago, and that again has been fully confirmed by the excellent oranges and other fruits grown from Californian seeds, trees, and grafts received in Sydney from Mildura, as well as by the very taking samples of canned and dried fruits sent us from that State.

Along the route by which I returned to Chicago—"The Santa Fe," there is a good deal of mountainous barren country in Southern California, and even where fairly level the land is sandy and dry, and a great deal of the State which adjoins Arizona is arid and valueless, with here and there along the coast tracts of fairly good wheat land.

From Southern California again through Arizona and New Mexico, the country, as seen from the train, is the worst I ever travelled through, being barren and arid, and the vegetation of the scantiest description with exceedingly few creeks or rivers, and what there were apparently sanded up and dry during summer for the greater part of their course.

From New Mexico the country improves as the line approaches the valley of the Missouri, where the far-famed corn-growing lands of America are situated, and in that of the Mississippi; and they continue to the vicinity of Chicago. As regards the land east of that city on the line to Boston the soil is comparatively light, and though generally of a kindly description and fair pasture land, it is not at all to be compared in fertility to the soil in the valleys of the Missouri and Mississippi. These remarks apply also in a considerable degree to the land along the railway from Chicago to New York, but on that line the land improves as it goes south, and approaches Philadelphia where some very good soil is seen.

While engaged at the Exposition I, of course, in accordance with the instructions I had received, took the opportunity of visiting the Union Stockyards in order to ascertain the number of stock which passed through the yards, what their quality was, how they were sold, the prices they brought, and to trace as far as possible the course of the American trade,—and I have now the honor to submit that portion of my report on these subjects which relate to the American Meat Trade.

I. The Number and Kinds of Stock.

The latest returns available give the live stock in the United States as under:—

Horses	16,081,000
Mules	2,314,000
Milch Cows	15,487,000
Oxen and other Cattle	36,608,000
Sheep	45,048,000
Swine	45,206,000

II. The Live Stock exhibited at the World's Fair, Chicago.

I will here enumerate the different breeds of the stock exhibited at the Fair as some criterion of the description and quality of the live stock in the United States; and I may say with respect to the show of live stock, that it was in my opinion more than equal in the number and variety of breeds, and fully equal in quality of the exhibits to the best displays of the Royal English,—the leading Agricultural Show of Great Britain.

1. *Horses at the World's Fair.*

(1.) Heavy Draughts.

Under this head, at the World's Fair, the Clydesdale, the Shire, the Suffolk Punch, the Belgian, the Percheron, and the Norman were well represented. With respect to the number and character of these different breeds in the United States, it may be said that while there are a great many excellent specimens of the Clydesdale and Shire horses in the States—and the Clydesdale is very generally to be met with—the draught horses there, taken as a whole, are comparatively light, being largely of the Percheron and Norman blood; and there is no doubt that for farm work the lighter horse is the better. Not only is this the case as regards the country districts, but also to a large extent even in the towns, where immense quantities of goods have to be moved, and where, instead of heavy, slow-going horses moving large loads, as in Great Britain and in the Colonies, in the American States teams of comparatively light horses (what might be termed powerful light harness horses), are to be constantly met at a trot with perhaps little more than half the load which would be put on the waggons in England or in the Colonies, but going twice as fast as the heavy draughts.

The Percheron and Norman horses are specially adapted for this system of transportation. They began to be imported in 1850, and so largely have they been so, that the blood of these two French breeds, especially the Percheron, is now much more generally distributed in the United States than any other of the draught horses.

The Percheron, of which, I believe, there have been no importations into this Colony, may be described as a very compact, short-legged, small draught horse, with a rather thick neck, straight shoulder, short back, full drooping hindquarters, and rather round bone. He is, as a rule, wanting in style and action, but is hardy, staunch, and good-tempered, and as a generally-useful horse, either for the country or in the town, where very fast work is not called for, is everything that could be wished. The lighter descriptions of the breed make good 'bus and parcel delivery horses.

The Norman is another French breed, and may be described as an upstanding, powerful, well-bred, well-shaped, light harness horse, with good head and rein. Like the Percheron, the Norman is very much used as a waggon horse in the American cities and also on the farms, but he is much superior in shape, action, and style to the Percheron; and as I believe the Normans would make excellent sires to put to our light, well-bred mares, I would recommend some of our horse-breeders to import them from France.

(2.) Light Harness.

The representatives of this description of horse at the Exhibition were the Cleveland, the Yorkshire coaching horse, the German coach horse, and the French coach horse, a very stylish animal.

(3.) The Saddle Horse.

This section included the English thorough-bred, the English hackney, the Morgan horse, the American hackney, the Arab, and the American, French, and Russian trotters. The breeds of horses in this section, which have not been introduced into Australia, are the American hackney and the French and Russian trotters. The American hackney is apparently a second but higher-standing edition of the English horse of the hackney breed.

The French trotter is a more stylish horse than the American, but not so fast; and the Russian, which has many of the characteristics of his Arab progenitor, also shows more breeding than the American, and is said, if properly trained and driven, to be as fast.

(4.) Shetland Ponies.

There were 85 entries in this section, and many of the exhibits were everything that could be wished in shape, action, style, and character.

(5.) Jacks and Jennets.

This was a well-filled section, and some very large and useful specimens were exhibited.

2. *Cattle at the World's Fair.*

(1.) Beef Cattle.

These were represented at the World's Fair by the Shorthorns, Herefords, Aberdeen Angus, Galloway, Red Polls, and Polled Durhams, and the display was a very grand one both as regards numbers and quality, more especially of the four first-mentioned breeds.

(2.) Milch Cattle.

The classes in this section were represented by the Jerseys, Guernseys, Ayrshire, Shorthorn, Holstein, Dutch Belted Cattle, and Brown Swiss; and the same remarks as to large numbers and excellent quality apply to most of the classes in this division, but with even greater force. This will be readily understood when it is borne in mind that there are over 16,000,000 of milch cows in the United States.

It was the importance of the dairy industry in the States that induced the Chief of the Agricultural Department to institute and carry out the elaborate experiments and tests conducted in the Dairy section of the Fair,—the detailed report of which may be shortly expected from America, along with other printed papers which are to be furnished to the Colonies and countries taking part in the Exposition. The Jerseys and Guernseys took the principal prizes at the Fair, both in the butter and cheese contests.

3. *Sheep at The World's Fair.*

This section was represented by the American Merino, the Delaine Merino, the Rambouillet, the Leicester, the Lincoln, the Cotswold, the Dorset Horn, the Southdown, the Shropshire Down, the Oxford Down, the Hampshire Down, and the Cheviot. Here again the classes were very well filled, and the sheep show was considered the most extensive and best of the kind ever held in the United States. There was a strong display of the American Merino, and a fairly good show of the Delaine breeds, and the exhibits in both these merino classes were of high quality.

There was also a good exhibit of extra large-framed well-woolled Rambouillet Merinos from Prussia. Several of the English breeds mentioned were forward in unusually large numbers; and, although a good many of the exhibits were not up to the English standard, there were others, more particularly the recent importations, that would hold their own in any showyard.

4. *The Pigs at the World's Fair.*

In this section the following breeds were represented:—The Berkshire, Poland China, Duroc Jersey, Victoria, Chester Whites, Essex, Large York, Small York, Tamworth, Suffolk, and Cheshire; and there is no doubt but that the show, if not the most extensive—there were 1,418 exhibits—was one of the best that has been seen in any part of the world.

The breed which made the most extensive display was the Poland China; but while this is the case—and the class was an excellent one, and contained many pigs of very high merit, and several were perfect models of what pigs ought to be—the Berkshire classes, although not so well filled as the Poland China, showed pigs of exceptionally high quality and form, and fully maintained the honor of the breed against their rivals of the Poland China blood.

These and the other black breeds find by far the greatest favour in the United States. For one white pig to be seen in the stockyards there are fifty black; and although the white classes were very fairly represented at the World's Fair, nothing like the same interest was taken in them as in the black breeds, especially the Berkshire and Poland China. These remarks apply also to the two red breeds—the Duroc Jersey and Tamworth; and with regard to the Tamworth, so much have the breeders of pigs in the States given their attention to shapes, early maturity, and propensity for fattening, that objections to the breed as regards these points were very freely expressed, and their good qualities of hardiness and large proportion of red meat overlooked.

III. The Chicago Union Stockyards.

1. *Their Extent, Capacity, and Business Arrangements.*

The stockyards were first erected in Chicago in 1856, with a capacity for 5,000 cattle and 30,000 pigs. In 1865 a new company was formed with a capital of £100,000, which acquired a tract of 320 acres of land (the site on which the existing yards now stand), and commenced business in December of that year with yards covering 120 acres, of various sizes, capable of accommodating from one to ten car loads, and 1,200 cattle pens and 1,000 sheep and pig pens were sufficient to accommodate the stock, while it now requires 2,000 cattle and 1,500 sheep and pig pens; and 50,000 cattle, 30,000 sheep, 200,000 pigs, and 40,000 horses may find quarters at these yards to-day. The horse exchange and pavilion is 530 feet long and 185 feet wide, with display track 36 feet wide and 530 feet long, and an amphitheatre sale-room capable of seating 3,000 people.

In 1892, 5,571,796 cattle, 197,576 calves, 7,714,435 pigs, 2,145,079 sheep, and 86,998 horses passed through the yards, while the largest receipts of stock in one week during that year were 95,524 cattle, 8,479 calves, 300,488 pigs, 69,966 sheep, and 3,679 horses.

On the arrival of stock at the sheds they are watered and fed at the following rates:—Hay, 4s. 2d. to 6s. 3d. per cwt.; corn, 4s. 2d. per bushel; and the yardage charges are: horses and cattle, 1s. 0½d.; calves, 7½d.; pigs, 4d. and 2½d.

There is an exchange building on the ground, with offices of some 140 commission firms, a restaurant, barber's shop, telegraph, &c., attached to the yards.

About 100 firms do packing and other business, and about 20 of these are prominently identified with meat-curing. Their plants are estimated at $5,000,000, with capital of $50,000,000; their employees number about 40,000, and the annual pay roll, $300,000,000.

There are about 150 miles of railroad trucks in the yards, and the various companies have an arrangement with the Market Company for all freight and traffic both in and out of the yards. The stock arrive during the night or early morning, and freight is despatched in the afternoon and evening.

The cattle, sheep, and pigs are sold by the live weight, and on the sale being completed, which it is by private bargain, and not by auction, they are sent to the scales, where they are inspected, weighed, and the certificated weight given.

The scales can weigh up to 100,000 lb., but the average weight of a carload is about 25,000 lb.

The following report of a week's transaction in stock at Chicago, which is taken from the *Breeders' Gazette*, of 20th June last, gives a good idea of the business done and the prices obtained at the Union Stockyards :—

2. *Report referred to.*

Numbers of Stock.

Day.	Cattle.	Calves.	Hogs.	Sheep.	Horses.
Wednesday	14,614	636	32,105	8,305	307
Thursday	13,415	897	32,640	10,150	208
Friday	7,317	495	32,680	6,688	188
Saturday	1,267	83	21,882	564	86
Monday	13,607	555	34,500	4,650	180
Tuesday	4,500	1,000	20,000	9,000	200
Sales for the Week ...	54,720	3,666	173,807	39,357	1,169

Prices of Cattle and Calves.

			Per 100 lb. $	$
First quality fully-matured beeves, from	1,600 to 1,700 lb.	live weight	4·90 to	5·10
Second quality choice smooth fat steers, from	1,450 to 1,600 lb.	„	4·65 to	4·85
Good to choice steers, weighing	1,300 to 1,400 lb.	„	4·25 to	4·65
Medium to good steers, „	1,200 to 1,300 lb.	„	4·00 to	4·50
Fat steers „	1,050 to 1,200 lb.	„	4·25 to	4·50
Common butcher's steers, weighing	900 to 1,200 lb.	„	3·25 to	4·00
Feeder's steers, weighing	900 to 1,200 lb.	„	3·25 to	3·75
Stocker's young steers, weighing	600 to 850 lb.	„	2·50 to	3·30
Butcher's stock, poor to extra, cows, heifers, mixed stuff, all weights, according to quality		...	1·25 to	3·75
Bulls, common to choice fat		...	1·50 to	3·50
Springers, common to choice, per head...		...	20·00 to	45·00
Veal calves, poor to common		...	2·50 to	3·50
„ fair to choice		...	4·00 to	5·00

Prices of Pigs.

	Per 100 lb. $	$
Common to prime light, averaging less than 200 lb. live weight	4·00 to	4·70
Pigs, averaging from 200 lb. to 275 lb.	4·50 to	4·85
" " heavier	4·60 to	5·00

Prices of Sheep.

Poor to choice sheep, per 100 lb. live weight	1·00 to	3·50
Yearlings " "	2·00 to	3·75
Spring lambs " "	3·00 to	4·50

3. *How Stock are weighed at the Union Stockyards.*

On being sold the stock are taken by an employee of the salesman to one of the scales, *i.e*, weigh-bridges which are provided by the Market Company, and there weighed by an officer of the company, who enters the weight in a register and hands a note of it to the person in charge; and the stock are paid for in accordance with the price agreed to, and the weight certified in the note. In this way all the purchaser has to judge is the quality of the stock, and, on the other hand, the seller is paid for every pound the stock weigh. I would recommend that the same course be adopted in the Colony at the principal markets, and that stock be sold by live weight.

An Act (copy of which Sir Saul Samuel has sent me) has recently been passed in Great Britain for the purpose of initiating the system of selling by live weight as in America, and weighbridges have been erected at the cattle-markets in the principal towns. I may add, however, that under the English Act it is optional for the seller to sell by weight, and the stock-owners have hitherto been somewhat slow in adopting that system, notwithstanding its advantages; but they are gradually coming to do so.

4. *The removal of the Abattoirs and their re-erection near the Saleyards.*

In going into details with respect to the Chicago stockyards and the conduct of the enormous business done in the Union Stockyards, one of my objects was to contrast the arrangements there with the manner in which stock are sold and slaughtered in Sydney, with the hope that I might thereby hasten the alterations which are so urgently called for in the mode of carrying on that business here.

For a long time the abattoirs on Glebe Island were a serious nuisance to the people of the Glebe and Balmain; but there has of late years been a change to a considerable extent in this respect for the better. The people in the suburbs, however, between Homebush and Glebe Island, are still subjected to the inconvenience and risk arising from the driving of the cattle to the abattoirs; and the cattle still suffer from the dogging and rushing and cruelty inflicted on them by the way, and the starvation they get in the waiting-paddocks,—while the waste and deterioration of meat, which all this occasions, is a serious loss to our stock-owners.

I would therefore suggest, as has often been done, that the slaughter-houses be brought as close as possible to the Flemington yards, or that an entirely new site be obtained where both the saleyards and slaughter-houses could be erected in close proximity to each other, and where there would be far more and far better waiting-paddocks for the stock than can now be conveniently obtained.

If the alteration first alluded to were adopted, then sufficient land on a suitable site on the old Homebush Estate, belonging to Mr. Wentworth, near

the Parramatta River—as at one time suggested by Mr. F. L. Barker—would have to be resumed; and if sufficient land were resumed, due care taken in selecting the site, and proper arrangements made for dealing with the offal and bi-products, no nuisance need be occasioned to the people in the neighbourhood. In proof of this I need only point to the Union Stockyards and Slaughter-houses at Chicago, which are in the centre of the city, to the slaughter-houses in London and all the other large cities in Great Britain, and to those in Berlin, Brussels, and Paris, on the Continent,—all of which are closely surrounded with shops and dwelling-houses, and occasion no nuisance beyond what the stock traffic entails—while the site now proposed, on the old Homebush Estate, would, if a sufficient area of land were resumed, be very isolated, and at a safe distance from dwelling-houses, other than those of the people at work at the yards and abattoirs.

If again the other alteration mooted were considered advisable, such a site as that indicated could, I think, be obtained on Mr. Wentworth's land some 3 or 4 miles beyond Parramatta, on the Great Western line; and if that were not at too great distance (less than an hour by train from Sydney) for the butchers to attend the sales, it would be the better site on account of the large extent of land which could be got at a reasonable price for the yards and slaughter-houses, and the number of paddocks in the neighbourhood which could be used by the stock waiting for sale or slaughter.

Should this alteration be entertained, and, say, 100 acres resumed, a good many of what are termed noxious trades—many of which are connected with stock and their products—could be carried on upon the same land; and its purchase would thus get rid of another serious difficulty. As regards the railway traffic, again; if the abattoirs are to be removed, and are not to be brought together, as here suggested, at Homebush, it will I think be seen that no more suitable site than that beyond Parramatta can be got, so far as railway accommodation is concerned.

IV.—The Cattle of the United States.

1. *Description.*

Although I had heard that the quality of the cattle in the States of late years had improved, I found it a good deal better than I expected on the occasions on which I visited the Union yards, and the beef in the slaughter-houses, to which visitors were admitted, was generally good, and in many cases very prime. But while this is the case, hundreds, I might say thousands, of very inferior cattle, principally poor cows, bulls, and stags were to be seen every sale-day in the yards which never left there alive, and were disposed of somehow—most likely in the shape of canned meats and sausages; and if this is the case it accounts for the small amount of nutriment which a great deal of the American canned meat contains, compared with that of the Australian and the New Zealand companies, which put up only prime beef and mutton.

The majority of the cattle in the Union yards had more or less of the Shorthorn blood, but they were in many cases polled, the system of dehorning being very general in the States. This, however, does not account for all the polled cattle brought forward, as there are not only a good many Aberdeen, Angus, and Galloway cattle, but also a breed of pure polled Durhams in the United States, which is fully recognised as such by the Breeders and Agricultural Societies, and, in framing the prize list of the Live Stock Show to be held at the World's Fair polled Durhams were

allotted a separate class. I would strongly recommend that the system of dehorning should be adopted in this and the other Colonies. The operation is easily performed, and the advantages of dehorning are too manifest to need anything to be said in its favour.

It will be gathered from the statement and description in this report of the different breeds of cattle exhibited at the World's Fair that most of the leading races of beef and milking cattle to be met with in Great Britain have been introduced into the United States, and with the best possible effect. But although the very great improvement noticed has been effected by these importations there are still in a good many instances rough cattle to be seen, which show very decided traces of the old Spanish breed, particularly among those offered at Kansas city, and there is yet ample room for the improvement, which has set in so strongly throughout the States, to continue and spread.

The best fat cattle offered in the Chicago market are, of course, those which, after having been fattened for a time on the pasture, are topped off on corn and hay; and a large proportion of these cattle, as regards size, breeding, and quality, compare favourably with the best Scotch, English, and Irish breeds of bullocks. In fact, taken as a whole, prime fat cattle of heavy weights are proportionately much more numerous in America than in Great Britain or Ireland, as the tendency there of late years has been to turn their fat stock off young, and not keep them to the ages and weights which they frequently attain in the States. This system of early marketing, which is spreading in the old country, no doubt pays the breeder best, while the consumer does not object to young beef if the cattle are well bred and prime fat; neither does the retail butcher, as young stock of this description give proportionately more meat and less bone. In the United States, however, it is different, and it suits the packing companies better in the circumstances under which the trade there is done to give longer prices per 100 lb. for heavy weights. For instance, while prime bullocks weighing say 800 lb. dressed weights sold at \$4·75 per 100 lb. live weight, the same day bullocks going 950 lb. and upwards brought \$5·25, and the difference which this discloses is quite a usual one.

The improvement referred to in the quality of the cattle in the United States, of recent years, has been quite phenomenal. Twenty years ago the greater part of the cattle in the States were very inferior, and the very best of them—some of those in the States east of the Mississippi—were only on a par with the second-rate Scotch and English cattle. Now, however, all this is changed, prime fat cattle are to be met with a good long way west of the Mississippi, and every week there are now being shipped to Great Britain from America 5,000 or 6,000 bodies of chilled beef, and 9,000 or 10,000 live cattle, the great proportion of which are prime and some very prime beef. No doubt a good many pure-bred cattle, principally Shorthorns had been imported previous to 1870, and larger numbers still in 1871, 1872, 1873, and 1874; but it was not until the chilled-beef trade, which was initiated in October, 1875, and successfully established (which it was very soon after), that the great influx of pure-bred cattle—principally Shorthorns, with considerable numbers of Herefords, some Devons, and afterwards a good many Black Polled cattle—took place, and continued up to a recent date. With these heavy importations of pedigree stock, a great many herds were formed to breed stud bulls, and as the export trade in chilled beef and afterwards in live fat cattle was a profitable one, and as both grass and corn of excellent quality were plentiful in the States, it can readily be imagined that owners were not slow in improving the quality of their meat, especially as they soon

found, what is now so well known to us, that to do a paying trade only meat of the best quality need be put on the London and other important markets in England.

The cost of fattening cattle in America is considerable, and it is this which will enable the Australian Colonies, where the stock are fattened almost wholly on grass, to compete successfully in the British and Continental meat-markets with the United States. There, very few cattle are fattened on grass alone; and it is the almost universal practice to give the cattle corn (maize) as well as grass—that is when grass is available, and where it is not, to supply hay or some other fodder instead. It takes from five to six months in this way to fatten a bullock, and during that time he will consume from 60 to 80 bushels of corn, costing at a moderate average price (say) 1s. 5d. per bushel, and with the grass, hay, or fodder supplied, would amount to (say) from £5 7s. 6d. to £6 16s. 8d. for each head of cattle. But from this would have to be deducted the profit, say 30s. to 40s., made by fattening pigs, the custom being to put (say) one pig in along with each head of cattle to fatten on the grass and on the corn which the cattle leave or drop.

2. *The prices made by Cattle in the Chicago yards.*

Prime fat bullocks weighing (say) 1,400 lb. live weight (which would be about the average of our best Australian cattle) have, during the first six months of this year, been selling at the Union Stockyards at prices ranging at from \$3·50 to \$5·15, and averaging during that time (say) \$4·17 per 100 lb. (*i.e.*, 17s. 4½d. per 100 lb., or 2$\frac{1}{10}$d. per lb. live weight), and that for 1,400 lb. would make the price in Chicago of a bullock of the description mentioned \$58·38, or in our money (calculating the dollar at 4s. 2d.) £12 3s. 3d.

To compare this again more closely with the prices current in our markets and those of the neighbouring colonies, it will be necessary to ascertain what the cost of the beef would be if calculated as it is in Australia by the 100 lb. dressed weight. With that view we will take the shrinkage at the rate usually allowed in prime beef, *i.e.*, 40 per cent. This leaves 60 per cent. of the gross weight of 1,400 lb. of dressed carcass, which would be 840 lb., and which costs £12 3s. 3d. This would make the price of prime fat cattle of the class mentioned sold on foot at Chicago, during the first half of the present year, 28s. 11½d. per 100 lb. dressed weight, or very nearly 3½d. per lb., a price which is nearly as high as prime American beef of that class often brings in London, taking both fore and hind quarters together, and such as would leave very little margin of profit to the American shipper after paying freight and charges, if he purchased at the prices quoted, and had to rely solely on the sale of the beef.

But, in the first place, although the prices given are those which I have quoted as ruling in Chicago, it may fairly be presumed that they are only given for beef of the very best description and primest quality, and that a great deal of the meat sent to Great Britain from America has been purchased at rates under those quoted as "top." This is in any case very probable, but I think it will be seen to be almost certain to be so when it is recollected that the meat trade in Chicago is very largely controlled by some six or eight of the leading companies in that city. Then the hide, fat, and other offal falls to the exporter; and, considering the exceedingly complete and thorough way in which the whole of the bi-products of the stock are turned to account and utilised by the great packing companies, they do not rely solely or even to any great extent on the amount realised from the carcass for a profit, inasmuch as they get large returns from the offal and bi-products. Then,

again, by clearing the American markets of a large portion of the stock these packing companies are able to keep control of the American home meat trade; and thus, although they may make little or no profit on the meat they export, they gain indirectly by its leaving America, and charge higher prices for what they dispose of there.

3. *Veal.*

During the period here mentioned veal was selling in Chicago at an average of say ½d. per lb. more than beef, but the price is a comparatively fluctuating one.

4. *How Cattle are slaughtered at Chicago.*

The cattle on being weighed are removed on viaducts built over the yards to pens in the packing-houses, which are in close proximity to the yards, and they remain there till required for slaughter, when they are passed singly into a narrow pen, over which a man with a long-handled hammer stands and drops the bullock with a blow on the forehead. Immediately he falls a lever is pulled, when the floor is raised at the back, and at the same time the partitions at the sides open and the carcass slides out upon the dressing-floor. There a man decapitates the body with a single stroke of the knife, others cut off the legs at the joints, another fixes hooks in the tendons of the gambel joints, others begin to skin the body; and in a very short time it is hanging dressed.

The backbone is then split with a cleaver, and the carcass is slid on an overhead truck into the chill-room.

In the meantime the heart and liver are dissected from the lungs and other portions of the body, and hung on hooks and racks, and the entrails and paunch are cleared of tallow.

5. *The Bi-products from the Bullock.*

These are the cheek meat, heart, liver, tongue, sweetbreads, tallow, blood, guts, weasand, bladder, hide, switch, and offal. The skin of the head, with that of the legs and tail, goes to the glue factory; the cheeks are used for Bologna sausages; the tongue is pickled and smoked; the skull goes to the glue-house, and is boiled, and then to the fertiliser factory; and of the feet the glue and bone houses get a part; neatsfoot oil is also obtained from them; the sweetbreads are made into pancreation; portions of the liver and heart are used for sausages; the blood goes to the fertiliser; and the horns are sold, to be made into knife-handles, buttons, and combs.

It is through the saving and utilising of absolutely every portion of the bullock that the packer can make a profit at the prices at which dressed meat is now sold to the retail butcher.

V.—The Sheep of the United States.

1. *Description.*

The sheep of the United States are usually spoken of and described under the following divisions or heads:—

(1.) "The Natives," *i.e.*, Mexican Sheep.—These are the descendants of the sheep introduced by the Spaniards into Mexico about three centuries ago, considerable numbers of which are still to be met with in that country, and some of the same breed are also to be seen in the south-western portions of the United States in a very un-

improved state; while the glaring defects in size, shapes, and fleece shown by a good many of the sheep on the ranches on both slopes of the Rocky Mountains, but more especially towards the south, clearly indicate that they are related, though perhaps distantly, to the original Spanish sheep, "The Natives."

(2.) "The Scrubs."—These are to be found in the South-eastern States (Florida, Alabama, Mississippi, and Louisiana), and may be described as the descendants of Mexican sheep, which have at times been interbred with sheep of improved breeds, but generally neglected, as the climate and soil in these States are not favourable to sheep-breeding.

(3.) "The Grade Merinos."—These include the offspring of all ewes, other than Merino, to which pure or well-bred Merino rams have been put, whether these ewes be Natives or the descendants of Native ewes and Merino rams, or of Merinos and crosses of Merinos and Natives, or Merinos and some of the English breeds, or the Merino and the crosses of the Merino and the English. But, of course, in many cases the pure Merino has been so often put to the descendants of the Native ewes that these grades show few, or none, of the faults of the Natives, and, in many cases, are classed as Merinos. This is not the case in regard to the crosses of the Merino and English sheep, for, as will be seen from what is afterwards said with regard to the direction in which breeding has lately been tending in the States, that it has not been, nor is now, the practice to return to the Merino, but rather to breed up for English or mutton sheep.

(4.) "The Merino."—This includes—

1. The Silesian Merino.—Live weight, fully matured, rams (say)	120 lb.;	ewes,	80 lb.
2. The Vermont	,, ,, ,,	130 lb.;	,,	90 lb.
3. The Delaine	,, ,, ,,	150 lb.;	,,	120 lb.
4. The Black Top	,, ,, ,,	180 lb.;	,,	130 lb.
5. The Dickson	,, ,, ,,	200 lb.;	,,	150 lb.
6. The Rambouillet	,, ,, ,,	250 lb.;	,,	150 lb.

(5.) "The English" *i.e.*, the Mutton Breeds:—

1. The English Leicester,
2. The Border Leicester,
3. The Cotswold,
4. The Lincoln,
5. The Southdown,
6. The Shropshire Down,
7. The Hampshire Down,
8. The Oxford Down,
9. The Suffolk,
10. The Dorset Horn,
11. The Cheviot.

Of these, at first the English Leicester was the breed most frequently used for crossing with the Merino; but, afterwards, the Cotswold was preferred, and latterly the Southdown and Shropshire have come into more general use in the States than any of the other British breeds.

This is especially the case as regards the Shropshire, which is now looked upon there as the best all round English sheep for crossing. The Oxford and Hampshire Downs have also been used to a considerable extent, and, more recently, a good few breeders have tried the Dorset Horn, and are satisfied

with the result. Lincolns have been but very little tried, which is rather strange, considering that the Lincoln with the Merino, while it makes good mutton, clips a much heavier fleece of excellent cross-bred wool than any other first class; and that the price of wool in the United States has for many years been very high.

2. *Estimated number of Sheep of the different classes in the United States.*

So far as I could ascertain, neither official nor any other reliable returns have been collected of the relative numbers of the different breeds or classes of sheep in the United States; and the only thing I could do towards arriving at any conclusion on this question was to obtain the opinion of gentlemen largely connected with the American wool trade, and that of the sheep-owners with whom I came in contact. This I did, and as it is of very great importance to our sheep-owners, both from a mutton and wool producing point of view, to learn how this matter stands, I now venture to submit the estimate given below of the different classes of sheep in the United States, based on the opinions I obtained, and in some measure, also, on information contained in the report published in 1892 by the Department of Agriculture on the Sheep Industry of the United States.

Estimate mentioned above:—

Scrubs	(say)	1,000,000
Natives and very inferior grades	„	3,000,000
Other Merino grades...	„	17,000,000
Pure Merinos...	„	5,000,000
Registered Merinos	„	1,000,000
Crossbreds (got by Merino ewes and British rams)	„	15,000,000
Pure-bred British sheep	„	2,500,000
Registered British sheep	„	500,000
		45,000,000

It may, perhaps, seem that the number of crosses of the British blood are over-estimated, and it may possibly be that they now are so; but if they are, it is only a question of very short time when the number stated will be considerably under the mark, for the report alluded to, by the Department of Agriculture on the Sheep Industry, clearly shows that in almost every State east of and including North Dakota, Minnesota, Iowa, Missouri, and Arkansas, the majority of the farmers, except where they own registered merino flocks, are using rams of some of the British mutton breeds, instead of the merino, with their merino ewes. They have discovered that while it does not pay to breed merinos on cultivated land, it does pay well to keep cross-bred sheep on it.

Not only is this the case with the farmers in the eastern portion of the United States, but in large portions of Texas, Oregon, Washington, and California quite as many, if not more, mutton rams are being used as merino; and it may be said that in all the States, even in those where the largest numbers of merinos and grade merinos are kept, and where formerly only merinos were bred, considerable numbers of crosses with English blood are being bred.

As I said, our sheep-owners are deeply interested in ascertaining how far the system of crossing now so generally followed in the States will be followed up, for if it is to become much more general, it will be a matter for consideration by Australian owners how far they will go into breeding cross-breds, seeing that, if the sheep-owners in the States adopt that system as generally as those in South America, the production of merino wool must decrease, and the owners in this and neighbouring Colonies might in that case do better to stick to the greater part of their merinos, and only breed a sufficient number of cross-breds to make up the surplus which we find it necessary to export.

Nor is this the only contingency which may arise. If the farmers in the United States go very strongly into cross-breeding with mutton-producing rams, there would then, in that case, be a good deal more mutton produced than could be consumed there; and if so, it is only natural that those now in the beef export trade should turn their attention to mutton, and send over to Great Britain large numbers of fat sheep both alive and in a chilled state. If this should happen, competition in the mutton trade, as well as the beef, would have to be faced by our sheep-owners; but, as I said, when alluding to that in beef, that the balance of the advantages is in our favour, and if they are turned to proper account, we are bound to win.

3. *The Quality and Price of the Sheep and Lambs in the Union Stock-yards.*

1. Quality.

Although there has of recent years been a very great improvement in the quality of the sheep and lambs offered as fat in the Chicago market, still a large portion of them are very inferior, many of them being not only badly fattened merinos, but merinos defective in size and quality. These defects were also noticeable in the cross-breds; and it was evident that the ewes from which they had been bred had not been of the right stamp, and that pure-bred rams of the best English breeds had not been used.

2. Price.

The average price in the Union stock-yards during the first six months of this year, of prime fat wethers of any of the Downs breeds, or first-class crosses from merino ewes and the best kinds of British rams, weighing from 60 lb. to 70 lb., has been about \$3·45 per 100 lb., or, say, 1¾d. per lb. live weight, which, taking the loss of weight in slaughtering at 50 per cent.—the usual rate allowed for shrinkage in fat sheep,—makes the wholesale price of the very best mutton in Chicago 3½d. per lb. dressed weight; the second grade, 2½d. per lb.; and the third grade, say, 1¾d. per lb., while there were a good many sheep at every sale which were sold at even lower figures than that last quoted.

The comparatively low prices which a large proportion of the fat sheep bring at Chicago is attributable to some extent to the demand for mutton being less steady than for beef and pork, but mainly to the scarcity of really prime sheep, which not only leads to the owners' direct loss in the low prices they receive, but also to their indirect disadvantage in as far as it renders it impossible for intending exporters to find a sufficient number of first-class sheep to make regular shipments.

I may state, however, that the low prices have been attributed to another cause. It is said that the mutton portion of the meat trade in Chicago has been "cornered" by three of the largest packing companies, who practically hold the control of it.

However this may be, there is exceedingly little mutton, either alive or dead, exported from the United States; and, to show how very insignificant that trade has hitherto been to Great Britain, I give the following extract from the Annual Statement of the Trade of the United Kingdom for 1892:—

IMPORTS FROM THE UNITED STATES.

Year.	Live Sheep and Lambs.	Fresh Mutton.
		cwt.
1888	1,203	7,157
1889	18,690	1,609
1890	3,904	134
1891	10,537	10,574
1892	2,829	72

At one time the consumption of mutton in the United States was very small, compared with that of beef and pork; but within the last fifteen or twenty years a considerable demand for mutton has arisen, and, although it is a somewhat fluctuating one, the demand is increasing, and likely to continue to do so, with the large increase in the number and quality of the mutton breeds of sheep now taking place in the United States.

4. *How Sheep are slaughtered at Chicago.*

Sheep are taken from the yards, when weighed, to the packing houses, and dealt with very much in the same way as cattle.

The most noticeable difference in the mode of slaughtering sheep at Chicago from that followed in the colonies is that, as in the case of cattle and pigs, different portions of the work of killing and dressing sheep is done by different hands, many of them on the work being only young lads.

Under this system the sheep is hung on an overhead truck and passed from one hand to the other, who each does his allotted portion of the work.

VI.—THE PIGS OF THE UNITED STATES.

1. *Description.*

As I have already stated, the leading breeds of pigs in the United States are the Berkshires and Poland-China, and of the two I understand the Berkshire and the pigs showing Berkshire grades are more generally distributed than the Poland-China, although that breed is also a very general favourite. In fact, the fat pigs to be seen at the Union Yards are apparently little else but Berkshire or Polands or crosses of these two breeds; and in no part of the world are there to be found anything approaching to the number, quality, weight, and uniform quality of the pigs offered day by day in the Chicago stock-yards.

In 1892 over seven millions of pigs passed through the Union Yards. This would give an average of very nearly 25,000 pigs a day; and when we consider how enormous this number sent to a single market is, and that the greater portion of these pigs dressed to more than 200 lb. each, we can understand how the United States can claim that the value of the products from the pigs in the States for 1892 amounted to $241,000,000, or about £60,000,000; and that after supplying her own people with all the pork,

bacon, hams, sausages, and lard they required she could export and dispose of pigs and the products of pigs, the greater part of excellent quality, to the value of $85,450,401, or, say, £17,000,000 sterling, as shown by the following statement:—

Extracted from the statement of agricultural exports from the United States for 1892:—

		$
Live pigs	....	364,081
Lard oil	901,575 gallons	496,601
Bacon	507,919,830 lb.	39,334,983
Hams	76,856,559 „	7,757,717
Pork, fresh	377,746 „	30,246
„ salted or cured	80,336,481 „	4,792,049
Lard	460,045,776 „	33,201,621
	Over £17,000,000	$85,977,248

This has been accomplished by improving the quality of the pigs, and keeping only those best adapted for the trade; by supplying them with plenty of the best kinds of food; by providing convenient markets for the disposal of the pigs to the best advantage; by erecting suitable packing houses with all the latest and most approved machinery and labour-saving and refrigerating appliances; by dealing scientifically with the whole products, but especially with what until recently was termed offal; by being exceedingly careful while sending out their products in as taking a form as possible to do a thoroughly honest trade; and last, but not least, by leaving no stone unturned till markets were found for their goods in all parts of the world. Dealing with the business in this way it was only natural that those engaged in it should succeed; and it can, I think, be fairly asserted that they have met with the success which they deserved.

I have frequently drawn the attention of our pastoralists and farmers to the advantage of increasing the number of pigs they kept, there being only some 300,000 in the whole Colony, while in the United States there are more than 52,000,000, giving a better and more certain return than any other description of stock.

We ought, with our exceedingly favourable climate, the abundance of both outdoor and indoor food for pigs, to have at least ten times as many as we now have; and if we adopt the means which have been so successful in the United States we must be as successful, for both as to climate and cost of food we have the advantage; and as regards bacon, hams, and lard, which require little or no refrigeration in transit to Europe, and can, therefore, be conveyed at comparatively low freights, we would not be placed at the same disadvantage as we now are with respect to some of our products, such as meat, butter, and fruit. The products from the pig can be both kept and carried at comparatively cheap rates. If anything further were required to be said in order to show the very great profitableness of pig farming the most convincing fact which could be adduced is, that with 52,000,000 pigs, those in the trade in the United States claim to have dealt with, what they speak of as an ordinary annual cast of pigs, *i.e.*, 24,000,000 pigs, or very nearly 50 per cent. of the whole number in the States.

This may at first sight appear to be a great exaggeration, but when it is recollected that a breeding sow has two litters a year, and that there will on an average be, say, seven in a litter, and that pigs at less than 12 months old, if properly fed, are fit for the butcher, the correctness of the statement need not be questioned.

In any case the extraordinary prolificness of the pig cannot be disputed.

I would strongly recommend the introduction of the Poland-China pigs. They have more "red" meat than the Berkshire, and make a fully wider side of bacon.

I cannot close this portion of my report better than by giving an extract from an article which appeared in the *Butchers' Gazette* of 13th June last, on the advantages of pig farming, to which the extract so forcibly calls attention; but I, of course, do not allow that nowhere outside the United States can it be so profitably carried on, for, as I have already stated, it can be so in this Colony, viz.:—"The hog is the only reliable money maker, the rent payer, the bread winner, and mortgage lifter *par excellence* of the Corn States. He may make more money for his owner some years than others; he may be overtaken at times by disease, but in the long run he always pays a handsome profit in any corn-growing district. Other countries may grow 'pigs' in comparatively small numbers, but nowhere outside of the United States can hogs making such astonishing weights at such an early age be produced in such enormous numbers at such slight cost. Only two weeks ago there were over 300,000 head bought and paid for at four primary receiving points in six days, and even that great 'run' was absorbed without a 'break.' There is no over-estimating the importance of the hog crop as a leading factor in American agricultural prosperity. We have virtually a monopoly of the world's markets so far as cheap or fine quality is concerned, and should make the most of it."

2. *The Price of Pigs in Chicago.*

The average price of prime heavy pigs in the Union stock-yards during the first six months of this year, weighing, say, 250 lb. and over, was $4·96 per 100 lb. live weight, which would make the cost of the pig in our money £2 11s. 8d., or, say, 2½d. per lb., and if the loss in killing were, say, 30 per cent. that would give a dressed carcase of, say, 175 lb., and would make the cost per lb. dressed weight, say, 3⅝d. per lb. The current price during the same period in the Smithfield market was about 5½d., which would seem to leave sufficient margin for fresh pork to be shipped from America to England; but it does not appear that any pork in a chilled state has been dealt with in that way, the packing companies having evidently made more money out of hams and bacon curing and pickled pork than they would have done by sending chilled pork to the British and other markets; and if additional proof were required beyond what I have already adduced of the profits which our pastoralists and farmers could make by breeding and fattening pigs and making pickled pork, hams, and bacon in an extensive and systematic manner, as the business is conducted in America, this fact should convince them of the soundness of my suggestions under this head.

3. *How Pigs are killed at Chicago, cut up, and utilised.*

Like cattle and sheep, the pigs are conveyed after being weighed to the packing houses, and there placed in receiving pens which are allotted to them in the third or fourth floor of the building in order that they may, while being killed and dressed, pass by gravitation from the one person to the other engaged in the work until it is completed. Although the mode in which this is done has more than once been described, I will here briefly state how it is so:—A portion of the pigs is confined in a small pen; a man stands among them and puts a clutch attached to a rope connected with a steam windlass on one of the hind legs of the nearest pig. It is immediately pulled up and

carried on a travelling truck to a butcher who sticks it. The pig then slides down the track into the scalding tank. There it is rolled about by machinery, and then lifted into the scraping machine (*i.e.*, a large box lined with brushes, the sides of which move up and down and rub the bristles off the pig), from which it passes on to two men, one on each side of it, who scrape off any bristles which the machine may have missed. The pig is then hoisted and passed on runners to the man who disembowels it, another cuts off its head, another washes off the loose bristles with cold water. The back-bone is then split with a cleaver, and the two sides are passed into the chill room. It is said that the whole of this work has frequently been done in less than twelve seconds.

While this is being done the fat is taken from the entrails, the tripe is sent one way, the heart and liver another. The entrails are cleaned and sent to the casing department, part of the head is sent to the sausage room, and the gut fat to the lard refinery.

In the division of the parts, the top of the head, the ears, and tail go to make "head cheese." The heart and liver are converted into liverwurst, the entrails into sausage casings, the stomach into pepsin; the bristles go to the hairfield to be sorted and baled for market, the feet and tongues are pickled and put in small kegs, and the blood, which is a powerful fertiliser, is caught and dried.

After from eighteen to thirty-six hours the carcase is taken to the cutting room, placed on a cutting block, and cut up with great cleavers; the hams and shoulders are sent to the curer, who keeps them for weeks in huge pickling tubs, in contact with a solution of salt, granulated sugar, and other ingredients, each curer having some secret formula which he jealously guards. Frequent handling ensures the absorption of the solution.

When thoroughly cured, the hams are washed in cold water and sent to the smoking house. Some of them contain 10,000 to 20,000 hams; and the smoke is made from hickory wood smothered by sawdust. Only reliable experts have charge of the smoke-houses.

VII.—The Manufacture of Bi-Products.

1. *Sausages.*

The production of sausages by the packers at the Union Stock-yards in 1892 amounted to about 75,000,000 lb., in which many of the parts of cattle, sheep, and pigs that would otherwise have been wasted were utilised. Where the manufacture is carried on everything is arranged with the view to thorough cleanliness, and the greater part of the work, including the chopping, mixing, seasoning, and filling, is done by machinery. If the sausages are made of pork, they are placed in the chill room till required to be sent out, and other sorts are sent to the smoke-room for a few hours and then boiled.

2. *Tallow.*

Considerable portions of tallow are still required for soap and candle making, but of recent years a new use has been found for it, and to-day millions of pounds are converted into olio oil, most of which is exported to Holland, to be there converted into butterine, but considerable quantities of that article are now also made in America.

3. *Glue.*

Hoofs, horn-piths, bones, and hide-trimmings are the bi-products from which glue is made. Enormous amounts of these materials were at one time wasted, but latterly turned to account, and some 15,000,000 lb. of glue are manufactured by the packers in Chicago.

4. *Beef Extract.*

The process of manufacture of beef extract consists in extracting the juices from lean beef by forcing cold water through the meat. These are boiled to coagulate the albumen in it, after which a whole clear liquid remains, which is reduced to the consistency of a paste in a vacuum kettle at a very low temperature.

5. *Wool.*

The wool is pulled from the sheepskins by means of improved appliances, and the pelts are cured and sold to the tanner. The wool is washed by machinery before it is pulled, and centrifugal wringers are used to dry it; and when pulled the wool is graded, dried with hot-air blowers, put in bales, and sent direct to the manufacturers.

6. *Pepsin.*

This article is made from the membranous lining of the stomach of the pig by dissecting this lining from it, and, after washing, putting it in earthen croches placed in shallow tanks and surrounded with water kept at a temperature of about 104° Fahr. The linings are covered with acidated water, which digests them in a few hours, after which the liquid is drawn off and naturalised by the addition of an alkali; then it is dried on shallow plates in hot-air chambers at a temperature of 124° Fahr. The drying process takes from six to twelve hours, after which it is scraped off. It is then the scale pepsin of commerce.

7. *Pancreatin.*

It is a new product, made from the pancreas glands, commonly called the liver sweetbread. Its medicinal value is its action on the liver and its power in digesting fats. The pancreas glands are cut fine and churned in acidated water and dried cloths, after which the product is treated by a gasoline process that extracts the fat from it; it is then ground into powder. There is an essence and glycerine made from it also.

8. *Butterine.*

Butterine is composed of butter, butter oil, neutral lard, and olio oil.

Creamery butter and butter made at the factory daily, are the milk products used in butterine.

Butter oil is made by pressing the oil from American cotton seed, and is used in small quantities to soften the texture of the butterine.

Neutral lard is a pure chilled leaf lard, cooked at a low temperature, and is then put into bath of pure water for about forty-eight hours, which removes all flavour, leaving a perfect neutral material.

Olio oil is made from the leaf, the choicest fat of beef cattle, which is chilled in ice water and then melted at a temperature of 140° Fahr. into truck tanks, where it is allowed to stand in a room kept at a temperature

sufficiently warm to keep it from hardening until it grains. From this is then pressed a perfectly soluble oil known as olio oil, which is the only beef product used in butterine, and the stearine remains in the press.

The above products, when properly combined, salted, and worked the same as butter, form what is known as butterine, which is one of the purest and most wholesome articles of food in greatest use.

9. *Hair and Bristles.*

The hair saved from the hide trimmings of the cattle hides, and the bristles from hogs, are taken to a field and spread out on the ground to cure. There they are stirred and raked about like hay till thoroughly dried. They are then baled and put in soaks. The best bristles are sold to brushmakers, and the rest go to the manufacturers of mattresses, &c.

10. *Bones.*

After the glue has been extracted from the bones those of them that are of no value for manufacturing purposes are dried and ground as fertilizers. The shank bones of cattle are sawn into pieces, and after boiling are dried and sent to the comb or button factory. Horns go to the same destination.

11. *Fertilizers.*

When any portion of the ox, the sheep, the pig, cannot be turned to better account it is made into manure, and, if blood, it is dried and ground. All the water used in washing, scrubbing, and cleaning is run into tanks and boiled and evaporated to the consistency of syrup. After that it is put in ovens and baked or dried, and then mixed with bone-dust or dried blood, packed in bags, and sent back to the farmers to help to make the corn and other crops grow to produce more beef, mutton, and pork.

VIII.—The Export of Live Cattle from the United States.

It will be seen from the amount which appears in the statement of the Value of the Exports of Animals and Animal Products from the States for 1892 (afterwards given at page 810 of this report, *Appendix A*), that this is a most important branch of the American stock trade. The statement referred to shows that 394,607 cattle, valued at $85,099,095 (*i.e.*, about £7,000,000) were exported that year. This would make a weekly average of 7,588 head. For 1893, the number was considerably less, only 248,825, and the value, £4,667,152; but it appears from the returns received for the present year, from 1st January to 16th August last, that the shipments this year (1894) will be considerably higher than those in 1893, for up to the date mentioned more cattle were landed in England from the United States than during the whole of 1893.

This increase seems still to be going on, and by the end of the year it is fair to assume that the number of cattle shipped to the United Kingdom will be equal, or nearly equal, to the heavy importations of 1892, and that the decrease in 1893 was a temporary and exceptional one.

The nominal rate of freights of live cattle from America to Great Britain is £3 per head; but with the present scarcity of cargo the rate is really a matter of arrangement between the shippers and the owners of the steamers, who are said at times to accept as low as £2 per head and even less.

There is nothing to report that is new with regard to the mode of shipping the cattle in America and securing them on the steamers, or better than that followed in the colonies, but the accommodation on board the steamers and the convenience for feeding and watering the stock is much better than is usually provided on steamers engaged in the Tasmanian and New Caledonian stock trade; and, what is of still greater importance, the system of ventilation is very complete and effective. This has been brought about principally by the supervision of Government inspectors, who see very strictly to the enforcement of the Acts and Regulations which bear on the shipment of live cattle, more especially of those which relate to the proper ventilation of the steamers.

Under the Imperial regulations live stock are not allowed to be imported from any country in which any infectious or contagious disease to which the stock are subject exists, except for slaughter at ports notified for the purpose, such as those at Deptford, Liverpool, or Glasgow, where quarantines have been set apart for the reception, sale, and slaughter of such stock. As, therefore, the Imperial authorities believe that pleuro-pneumonia exists in the United States, and also in Canada, all the cattle imported from either of these countries have to be landed at one or other of the ports mentioned. They are there taken to the lairs provided for them in the sheds at the dock, and tied up until their turn comes to be offered for sale, when they are run out singly into the sale ring, around which the purchasers are seated, and sold by auction. They are then taken back to the lairs and removed to the slaughter-houses, which are attached to the lairs, and slaughtered as required by the purchasers, and the carcase and offal are inspected before they are removed.

If it should be found that a paying trade in live stock from Australia can be established, our cattle will have to be dealt with in the same manner as the American now are, for we cannot certify that our herds are entirely free from pleuro-pneumonia.

When in Glasgow I attended a sale of American cattle, the greater proportion of which were anything but prime, and they brought prices ranging from 37s. 4d. to 51s. 4d. per cwt., or say 4d. to 5½d. per lb., on the foot, according to quality; but prices for prime American, especially at Birkenhead and Deptford, rule higher than those here quoted, and at times reach as high as 56s., and for very prime even 58s. per cwt.—say 6d. to 6¼d. per lb. It may be said that American cattle sell at Deptford, Liverpool, and Glasgow Docks at about 1s. per stone of 8 lb. less than home-bred stock of the same grade of quality and condition.

The accommodation at these quarantines where the foreign stock are slaughtered is excellent, and there are now very extensive cool rooms attached to them, where the meat can be chilled and kept at a reasonable charge till required; in fact, everything possible is being done to promote the live stock trade, as butchers can not only make money out of the offal, but the beef of American cattle slaughtered in England can, of course, be more readily passed off as Scotch or English than that which comes over chilled. This has helped on the increase in the shipments of live cattle from America during the last three or four years; but the principal reason for the increase is that live stock have of recent years, with the improvement of the accommodation on the steamers, the decrease in losses on the voyage, and the cheap freights through the depression in the shipping trade, paid the shippers in America better than the chilled meat.

IX.—The Chilled Meat and Export Trade.

In Chicago it may be said that the chilled or fresh meat trade has, so far as the American Home Trade is concerned, now taken the place of the live stock; for although a good many cattle intended for shipment alive to Europe and for slaughter at Boston and New York, for shipment in the shape of chilled meat to Scotland and England, are purchased in Chicago, the business formerly done there in selling live stock, which were taken and slaughtered at the principal towns in the States, is now practically supplanted by the adoption of the chilling system, which not only puts the packing companies in a position to carry on an extensive business in exporting chilled meat to Great Britain, but enables them to supply much better, as well as cheaper, meat to the consumers in the States. In carrying on the Home trade the more extensive Chicago packing companies have branches for the purchase and slaughter of stock at the principal centres of the stock traffic, such as Kansas City, Omaha, Denver, St. Louis; and for the sale of the meat and other products they have agents, and in some cases cold stores, at the larger towns, who receive regular consignments of fresh meat, bacon, hams, sausages, and other articles from Chicago, and supply the retail butchers, provision merchants, and grocers. To show the magnitude of the chilled meat trade done by the leading packing companies in Chicago, it may be stated that Swift and Company use over 3,000 refrigerator cars, and Armour and Company 2,250.

So very advantageous has the chilling of meat been found that not only at all the principal centres of the stock traffic, but almost all the slaughter-houses in the States are provided with chill rooms, into which the stock as slaughtered are regularly passed, with the view to the meat being cooled and set as quickly and as thoroughly as possible.

Then where the meat is intended for distant parts of the States, but especially where it is so for exportation to Europe, special care has to be taken that it has been thoroughly cooled and set, so that it may not only be carried without risk of taint to its destination, but that it shall also have sufficient keeping margin to admit of its being sold to the butcher and retailed by him in a perfectly sound condition. This is effected by keeping the meat in a chill room for (say) forty-eight hours, in the first instance, of course, at a moderately low temperature, but during the last portion of that time at a temperature a little below freezing point, and still lower (it has been said as low as 28° or 29° Fahr.) during the voyage from America to Europe; and so effectually is the chilling carried out that while some 5,000 or 6,000 bodies of chilled beef on an average now reach Great Britain every week from America, it is very seldom that any of the meat is landed in bad order.

The only case of the sort which I heard of while in England was that of a shipment which, through a breakdown of the steamer's machinery, was thirty-five days in delivering her cargo.

With the view to illustrate to some extent the course of the chilled meat trade carried on from America to England, and to give our owners as much reliable information as possible with respect to the prices in the States for store and fat stock, to enable them to compare their prices with those ruling in this and the other Colonies, I have prepared, and submit below, a *pro forma* statement of the dealings with a store steer $3\frac{1}{2}$ years old from the time he is sold to the farmer, by whom the steer is fattened, until he is disposed of in England as a carcase of prime chilled beef, the prices appearing in the statement being averages for the half-year from 1st January last, made up from prices given in the leading Chicago Agricultural Journal.

STATEMENT of Cost of Chilled Beef in America, and Price realised in England.

Statement so far as the Farmer is concerned.

	£ s. d.	£ s. d.
Cost of store bullock of improved grade, 3½ years old, 1,200 lb. live weight, at \$3·18 = \$38·16 ...	... ...	7 19 0
Cost of six months' feeding, (say) 60 bushels corn, at 85c.	4 7 6	
One ton hay, at \$7·20	1 10 0	
		5 17 6
Trainage to Chicago	0 10 0	
Yardage, 1s.; food, 2s.; and commission, 2s. ...	0 5 0	
		0 15 0
		14 11 6
Selling price in Chicago as a prime fat 4-year old bullock, weighing 1,450 lb., live weight, at \$4·50 per 100 lb., or 4½c. per lb., or dressed weight, the carcase giving 60 per cent. meat = 870 lb., at 18s. 9d. per 100 lb., or 2¼d. per lb.	13 11 10	
Add—		
Profit on one pig, fattened along with the bullock (say)	1 5 0	
		14 16 10
Profit to the farmer		£0 5 4

Statement so far as the Shipper is concerned.

	£ s. d.	£ s. d.
Price of bullock at Chicago, weighing 1,450 lb. live weight, or, as before, 870 lb. dressed weight, at 2¼d.	... ...	13 11 10
Add—		
Slaughtering in Chicago	0 2 6	
Chilling	0 2 0	
Loading	0 1 0	
Freight by rail to New York, 870 lb., at 45c. per 100 lb.	0 16 3	
Loading on steamer	0 0 6	
Freight to England	1 10 0	
Expenses, including steamer, carting meat to store, storing, and delivering ...	0 2 0	
Commission—selling	0 6 9	
	3 1 0	
Less—		
Received for bi-products, including cheek meat, heart, liver, tongue, sweatbreads, tallow, guts, weasand, bladder, hide, switch, head, skirts, feet, shank-bones, offal, containing other bones, blood, &c.	1 10 0	
		1 11 0
Amount realised in England for 870 lb. carcase ...	... ...	15 2 10
Sold there at 2s. 8½d. per stone, at 8 lb., bring=4$\frac{1}{16}$d. per lb.	... ...	14 14 6
Apparent loss		£0 8 4

It will be seen from the foregoing statement that if the prices there given were actually paid, the transaction left neither the farmer who fattened, nor the shipper who purchased in the Chicago market, any profit. No doubt with the assistance of the pig, which was kept with the steer at but little additional cost, the farmer realised a trifling profit, but certainly not sufficient to reimburse him for the trouble, risk, and expense he was put to in the transaction, while the shipper sustained a loss; and the question seems to arise whether, looking at the price paid the breeder of the steer, and the amount he realised in Chicago and London, he did not in selling at £7 19s. receive too high a price for him. This is a most important point, for it has a direct bearing on the question whether the American stockowner can successfully compete with the Australian in the production of meat, and it would seem that that depends upon whether the breeder of the store steer (who, as a rule, is the owner of a western ranch) can make the breeding of store cattle pay, and sell at a figure which, keeping in view the price beef sells at in Great Britain and on the Continent, will enable the farmer who purchases and fattens the steer, and the shipper who purchases from the farmer for export, to make a fair profit in carrying on their portions of the trade; and I think, looking at the differences in the price of store and fat stock in the colonies, that the breeders can afford to breed and rear store steers for considerably less money than £7 19s., and my reasons for saying so are the following:—

1. If the breeder is occupying Government land he pays no rent unless the land he has is, as it sometimes has, but not very frequently, been vested in the Education Department of the State, and then the rent is very low.
2. If again the breeder is occupying land belonging to any of the great railway companies (of which there are large areas in the Western States acquired as land grants for making the railways), then in that case the rent charged him is also low, and besides he is usually able to obtain the use, without payment of rent, of considerable areas of Government land adjoining that leased from the railway company. I consider, therefore, that even if the breeder of the store steer had in very cold weather to provide some fodder to bring his cattle through the winter—which is necessary in exceptionally heavy falls of snow on the higher lying ranches in the west—he could afford to breed and sell store steers 3½ years old at, say, £6, which is £2 a head less than the price given in the above statement for the store steers; and I think that such a reduction of the prices now current in England and on the Continent for prime fat cattle continue at the present figures, would admit of both the farmer fattening and the shipper who sells in these markets making fair profits.

X.—Meat Canning.

Canned meats are put up by several of the larger packing companies in Chicago, among whom Nelson Morris & Co., Armour & Co., and Libby, McNeill, & Libby do the most extensive business in that line. In canning corned beef the meat is trimmed from the bone and slightly corned, after which it is cooked and pressed into cans by automatic machines worked under experienced eyes. The cans are all filled correctly with the right quantity, according to scale, in far less time than it takes to tell it. They are then capped and processed.

The latter work is the insertion of the can while closed in a steam-heated retort, which brings the contents to a heat and fermentation that forces the air to the top, when the can is perforated by a needle-shaped instrument, and the air escapes with a rush. The can is then sealed tight, and the contents are thus rendered proof against the climatic changes to which they may be exposed; after this the cans are washed, dried, painted, and labelled, and packed in cases ready for shipment.

The principal noticeable features in the American canning trade were:—

1. The numerous and very effective labour-saving appliances in the handling of the meat, the making and filling the cans, the printing and putting on the labels, and the construction of the packing cases.
2. The colour, consistency, and taking appearance of the meat when the can is opened, which not only gives a favourable impression of the quality of the meat, but makes it very suitable for being retailed—as the 6-lb. and 14-lb. cans frequently are by grocers and others—by the pound, and even half-pound.
3. The bright and taking appearance of the can and label.

XI.—Salted and Pickled Beef.

The importance of this branch of the meat trade has of late years become considerably less. This has arisen principally, of course, through a great deal of the meat which was at one time salted being now chilled. Only the best beef is suitable for salting, and as this quality has been found to pay better chilled than salted, the more profitable course has been adopted. Besides this, both chilled beef and frozen beef and mutton have, in a vast number of cases, more particularly on board ship, taken the place of salted meat, and it is likely to do so more and more. Still the quantity of salted and pickled beef and pork exported from the United States is very considerable. In 1892 the quantity of salt beef sent away was 70,204,736 lb., valued at 3,987,829 dollars, and of pickled pork, 80,336,481 lb., valued at 4,792,049 dollars, the aggregate value being 8,779,878 dollars, or, in our own money, taking the dollar at 4s. 2d., £1,829,141 5s., a very large amount.

As this is the case, and as both salted beef and pork can be produced more cheaply in Australia than in America, while they are articles which, when properly cured, will keep for any length of time, and can be transported at comparatively low freights from one part of the world to another, it will be seen that this branch of the meat trade is one of great importance to our pastoralists and farmers, especially when it is considered how very necessary it is that every portion of the carcase should be put to the purpose for which it is best adapted, and will make the best return to the producer.

To make meat-curing a success, the work must be done at a low temperature, and, as I have elsewhere pointed out, the packing companies in the United States, notwithstanding that there were as good and very much cheaper cattle in Australia, long ago obtained a monopoly of the salt-beef trade, through being in a position to harvest aud store in their curing-houses large quantities of natural ice from Lake Michigan, at a cost of only a dollar a ton, which enabled them to do the work at a temperature of about 40° Fahr. all the year round. Now, however, they have no such advantage, as it has been found cheaper and better to obtain the necessary cold by refrigeration, and as there are a good many freezing and chilling works in this

Colony and in Queensland, there is no reason why, with the low prices of beef in Australia, compared with America, these colonies, more particularly Queensland, should not secure, if not the whole, the greater part of the salt-beef trade of the world, if the work is done honestly and carefully.

I am glad to hear that, largely with this object in view, the services of an expert, with Chicago training, have been obtained by the Queensland Government, and that a trial shipment of beef, cured and packed under his supervision, has been forwarded to London; and I trust that not only on the quality of the beef, and the portions packed, but also on the colour and condition of the meat and the package in which the shipment is sent, it will be equal to the very best American, for there is a strong prejudice against Australian salt beef on account of the inferior article which we have hitherto put up, and the American packers and their agents in London will use every effort to prevent the trade coming to Australia.

XII.—How the American Shipments of Live Stock and Meat are disposed of.

I have already made a passing allusion to the effective manner in which the shippers of live stock, meat, and other products from the United States push their sale. They have thoroughly reliable agents in the countries to which their consignments are sent, who not only see that they are disposed of to the best advantage, but narrowly watch the markets and keep their principals advised as to their prospects. It is believed, too, that, notwithstanding the trade rivalry between the different shippers, their agents—several of whom are members of the firms they represent—co-operate as far as possible in preventing the shipment of over-supplies from the States, and in regulating prices and saving the consignments from being sacrificed. But, while this is said to be the case, I understand that the co-oporation is only temporary, and the arrangement as to prices a verbal one. The shippers' agents dispose of large quantities of the consignments themselves; but a good deal of them are also placed in the hands of auctioneers, brokers, and salesmen, who dispose of them under the close supervision of the shippers' agents.

XIII.—The Bearing the United States Beef Trade has on the price of Frozen Mutton.

I have gone at considerable length into the particulars of the American beef trade with the United Kingdom, both as live stock and chilled, because, although the importations from New South Wales at least will consist principally of sheep, the American cattle trade, more especially in the shape of chilled beef, has a very important bearing on the price of our frozen mutton in England. For those who purchase frozen mutton also at times buy chilled beef, and as the majority of them prefer beef to mutton, the result is that when the price of chilled beef is so low as to be only a little higher than frozen mutton, the beef is purchased in preference to the mutton. Then again, the American shippers are so very much nearer to England than those in Australia, and so very well and promptly advised by their agents as to the state of the meat market and its prospects, and have always ample supplies of beef at their command, that they can take advantage of the slightest rise in the market, and send over at once full supplies of beef, and, notwithstanding that it frequently sells at prices which, taking those

quoted in the Chicago market and those realised in England, must, after paying freight and charges, be anything but remunerative to the shippers, heavy shipments continue to arrive every week, and, of course, have a depressing effect on the Australian and New Zealand frozen meat trade.

The effect of the American supply on the British meat market will, however, be better grasped by our owners when the enormous quantities which were sent over during last year, in the shape of cattle and chilled beef to Great Britain, is put into the equivalent of Merino sheep weighing (say) 50 lb. each thus:—

	Sheep.
248,825 live cattle, each 900 lb. dressed weight, is 223,942,500 lb., or, say	4,478,850
14,589,949 cwt. fresh beef, which is, say	3,337,485
Equivalent in Merino sheep	7,816,335

That is to say, the quantity of beef sent in 1893 by the United States to Great Britain is considerably more than twice as much as the mutton shipped there by all the Australian Colonies, while the American supply for that year was less than that for each of the previous three years.

XIV.—Will present extensive Shipments from the United States of Fat Cattle and Chilled Beef continue?

I have heard the remark repeatedly made that it is only a question of comparatively short time when the United States, with the rapid increase of population from natural growth and immigration, will require all the meat she can produce, or, at least, that with these additions to her population, meat will rise to a figure which must make the price too high to export, and, of course, that Australian beef and mutton would then bring better prices.

As will be seen from the figures I have already quoted, there was a considerable falling-off last year in both the live cattle shipments and those of chilled meat; but, as I have shown, this decrease was only a temporary one, for the shipments of both live cattle and fresh meat have been heavy since the beginning of the present year, notwithstanding that the prices received in England for both the live cattle and meat were apparently unremunerative. But even if the supply of meat were to run so short in the United States as to diminish the quantity exported from that country, it would not fall solely to Australia to make up the deficiency; for not only is Canada steadily increasing the production of meat and shipping regularly to Great Britain, but the supply of beef and mutton from South America is bound both to improve in quality and increase in quantity, as there are large tracts of country in Argentine, and also in Uruguay and Paraguay, well adapted for cattle, still unstocked; and the improvement of the quality of both cattle and sheep is now making rapid progress in all parts of the world, and especially in Argentine.

But, apart altogether from the supplies which may come from the countries to which I have here alluded, in order more thoroughly to put our owners on their guard against relying on any considerable decrease in the shipments of live cattle and fresh meat to British and Continental markets, I fear that a shortage, such as that which some of our owners are expecting to take place in the United States, will not occur; for—what with the additions which are certain to be made there to the present area of land

under tillage, with the improvements by fencing and water-conserving which will be effected on the native pastures, with the adoption of better systems of crop-growing, the laying down more land in cultivated grasses, the growing of roots and green crops, and in the breeding, management, and fattening of stock—it may, I think, be fairly assumed that the production of beef and mutton in the United States will, for a considerable time at least, keep pace with the growth of the population, especially if it should happen, as there seems to be considerable probability of its doing, that the emigration to America will not in the coming decade be so extensive as in the past. On this point *see Appendix* B, which gives an estimate of the meat supply of the United States and of the probable surplus for export.

So much as regards the supply of meat likely to be sent from the United States. With respect again to the price at which it will pay stock-owners and farmers to breed and fatten stock for export to the British and Continental markets, some idea of this may, I think, be gathered from what I have already stated, more especially from the *pro forma* statement which I submit in connection with the chilled meat trade; but I may add here on that point, that as there is no prospect of the land in the United States being turned to better account (grain-growing would not pay better) than by breeding and fattening stock, it must, I think, still be devoted to that purpose, and if so the stock must continue to be sent to the British and Continental markets; and it seems to be not so much a question of what price the American breeder and farmer considers it will pay them to produce and send meat to these markets, as what price the meat will bring in competition with that sent from New Zealand, Australia, and South America. That, in fact, the meat has to be produced in America and exported and sold for what it will bring. In any case the change, which those who make these statements expect, must be a gradual one; and as stock-owners in this and the other Colonies need immediate relief, it will be for them to do their best, with the least possible delay, to make the advantages they possess of a more equable climate, better breeds of stock—more especially of cattle and cheaper food for them—more than counterbalance those which enables the American farmers not only to send their meat in a chilled, instead of a frozen, state to Great Britain, but also to ship live stock at a low rate of freight to the Deptford, Birkenhead, Glasgow, and other docks, where they bring better prices than those obtained for even chilled meat. When I say that our owners must do their best, I mean that they should breed and fatten stock of the primest quality and of the sort best suited for the markets to which they are to be exported; that, if sent away in the shape of meat, the works for its preparation should be of the best and most approved description, so arranged as to economise labour in all directions, and with so many and so very complete sets of appliances as to be able to deal not only with every class of stock, but even with every portion of each head of stock in the most advantageous manner; while every bit of the bi-products must be turned to the best account; and, above all, that there should be thorough co-operation, not only amongst owners in each Colony, but that the owners in all the Australian Colonies should as far as possible work together, especially in regard to the supply of shipping and the distribution and sale of the meat in the countries to which it is sent.

I have thought necessary here to say this much as to what owners should do; but I will, of course, when reporting on the sale of Australian meat in Great Britain and on the Continent, point out in detail the course which I think owners should take in disposing of their surplus stock, and give my reasons for the recommendations which I make.

APPENDIX A.

HAVING, in what I have already written, described the different ways in which the animal products of the United States are utilised and prepared for sale, I will here, by way of criterion as to their relative value, give the statement which appeared in the Annual Report of the Statistician of the Department of Agriculture of the United States for 1892.

Agricultural Exports, 1891 *and* 1892.

Animals and Articles.	Quantities.	Value.
Animals, living—		
Cattle	394,607	$35,099,095
Horses	3,199	608,708
Mules	1,992	241,071
Sheep	46,960	161,105
Pigs	31,963	364,081
Other and Fowls	....	24,161
Animal Matter—		
Bones, Hoofs, Horns, Tips, Strips, and Waste ...	....	218,639
Casings for Sausages	....	878,675
Eggs ... ... doz.	183,063	32,374
Glue ... ... lb.	580,815	66,403
Grease, Grease Scraps, and Soap Stock	....	1,298,598
Hair and Manufactures of	....	370,169
Hides and Skins other than Fur	....	1,211,620
Honey...	....	78,048
Oils—		
Lard ... ...gallons	901,575	496,601
Other Animal	278,954	144,119
Meat Products—		
Beef Products—		
Beef, Canned ... ... lb.	87,028,084	7,876,454
„ Fresh	220,554,617	18,053,732
„ Salted or Pickled	70,204,736	3,987,829
„ Otherwise Cured	953,712	92,524
Tallow	69,780,010	4,425,630
Mutton	101,463	9,022
Oleo Margarine —		
Imitation Butter	1,610,837	195,587
The Oil	91,581,703	9,011,889
Pork Products—		
Bacon	507,919,830	39,334,933
Hams	76,856,559	7,757,717
Pork, Fresh	377,746	30,246
„ Salted or Cured	80,336,481	4,792,019
Lard	460,045,776	33,201,621
Poultry and Game	....	13,828
All other Products	....	1,220,205
Dairy Produce—		
Butter	15,047,246	2,445,878
Cheese	82,100,221	7,676,657
Milk	....	236,358
Wax, Bees	127,470	31,898
Wool, Raw	202,456	30,664
Say... ... £37,857,955 16s. 8d. ...	....	$181,718,183

APPENDIX B.

Estimate of the Meat Supply of the United States of America, and of the surplus for Exportation:—

Population.

Population in 1890	62,622,250
Proportionate increase for 3 years, 1890–93...	3,739,940
	66,362,190

Consumption.

Say population, 66,000,000, consuming meat at rate of 120 lb. per head per annum	7,920,000,000 lb.

Number of Cattle, Sheep, and Pigs, and Annual Increase:—

No. of Cattle in United States	52,095,568
Allowing increase at rate of (say) 11 per cent., would give	5,733,511 Cattle
No. of Sheep in United States	45,048,017
Allowing increase at rate of (say) 13 per cent., would give	5,856,242 Sheep
No. of Pigs in United States	45,206,498
Allowing increase at rate of (say) 47 per cent., would give	21,247,054 Pigs.

Production of Meat.

Cattle, 5,730,511, × 750 lb.	4,297,883,250 lb.
Sheep, 5,856,242, × 60 lb.	351,374,520 „
Pigs, 21,247,054, × 175 lb.	3,718,234,450 „
	8,367,492,220 lb.
Less quantity required for consumption...	7,920,000,000 „
Estimated surplus for Export	447,492,220 lb.

Which is equal to (say) 8,949,844 Merino Sheep, at 50 lb. each.

The Silk Industry.

By JAMES FRY.

Next before the article on Silk, in August, was Sir A. Cotton's article on Deep Cultivation. After my reading of both,—a reading with interest of the vast possibilities which lie in scientific farming, as demonstrated by that retired Indian Officer on his native British soil, and of the signs of progress in the infant industry of silk here—it was my hap to read the history with what science and with what progress will soon be seen, of a British attempt to establish an almost untried form of the silk industry on Indian soil. This was in the official report on Economic Products, published at Calcutta, 1893, under the authority of the Department of Agriculture. It was very suggestive reading. I propose to show how there is matter in both this report and Sir A. Cotton's article which has an important bearing here on the silk industry.

Great Britain has more than once attempted to grow silk, but climate is against it. When, in some of the Colonial offshoots, there was found to be a climate equal to the most favoured regions in Europe for silk-growing, thought naturally went upon the vast possibilities which lay in such an industry, if the furthest point reached by scientific advance in Europe were made the starting-point by British enterprise and vigour in Australia,—supposing that on this suitable soil, under this suitable climate, the British earth-worker should devote himself to extensive silk-growing, for the first time in its history, and on this his first real opportunity. There had been so much advance in the methods of growing in Europe as to reveal the scope there was for much more. And Australia had before its eye its own wool, in which, by care in breeding and other progressive improvements, it had produced some that could sell at a price unequalled in the world's markets. Those improvements in Europe were such as capital could bring about, though capital, as we shall see, brought disadvantages with it. But the rearing of the worms was, and is still, for the most part done by the peasantry; and the peasantry of a country are not, as we know, quick to adopt innovations, though they be improvements. The Australian earth-worker, on the other hand, hampered by no traditionary methods handed down from father to son, was open to adopt any methods that promised best.

Capital, however, was needed for the purpose, and it was not forthcoming: instruction was emphatically needed, and until recently there was no chance of getting it. I might add, there was still more emphatically needed the dispelling of prejudice. We may name, first, as fit to be called a prejudice, boyish recollections of the interest taken in feeding some dirty silkworms, and winding-off the pretty silk. When a man alleges this as a sort of reason why he would like to see the silk industry established, it is a bad sign. Better to be as free from knowledge as was the great Pasteur, who,

when called in by the French Government to deal with the dire silkworm disease, confessed that he had never handled a silkworm in his life, and knew nothing about them. There was nothing to unlearn. Commercial silk-growing is just the antithesis of amateur work. But there are far more serious prejudices to overcome than this. Probably the valuable report of Mr. W. S. Campbell, published by the Department, has done more to dispel prejudice, and to open the eyes of the public to the possibilities in silk-growing, than all other agencies.

Capital has, as I said, and as we shall again see in the Indian experiment, disadvantages. It is so easy to use it unwisely; and be it at once admitted, there are more than ordinary risks. It is a pecularity of silk-growing for commercial profit, that wrong methods are fatal; right methods are in the long run the cheapest; the only way of making it produce wealth. To examine into these methods, and into the whole question of growing the staple which is second to none in the world in the money values it directly and indirectly represents, is surely more rational than the spineless attitude of those who argue from the fact of the British race having never hitherto grown silk, that the industry is unsuited. Until it possessed temperate regions verging on the sub-tropical, it never got the chance. Wherever climate suited, the British race has been ready to grow cotton, tea, indigo—anything. When first its chance came to grow silk—in the southern colonies of America—the growing was begun, but the cotton soon displaced it, and there are good reasons which account or this. The attitude now of Australia should rather be that of earnest, intelligent, painstaking inquiry into this gigantic industry. Mulhall estimates the world's production at 300,000 tons of cocoons annually, equal to 52,000,000 lb. of raw silk, of which one-sixth, or 50,000 tons, is consumed in Lyons alone. The peculiar risks to capital spring largely from imperfect knowledge. Hence, also, workers in the industry for a livelihood are easily discouraged, and when discouraged are apt to magnify *their* risks. The fact is, and in one view it adds a fascinating interest to the employment, the tiny animal that initiates results which, seen in their magnitude, may remind us of those of the coral insect, has to be carefully, and we might almost say lovingly, tended during its brief and excitable life of thirty or forty days in the service of man. It has allowed itself to become domesticated. It cannot put up with being neglected. It seems sometimes as if it really *responded* to all the care and attention given to it. A poet has sung the praises of a certain flower which, as distinct from other flowers, seemed to him to have mysteriously "some concord with humanity." The rearer, in the course of his rearing, is sometimes impressed with a feeling that, as distinct from the rest of the animal world, this highly organised and sensitive little creature, which seems almost to know he is near and to welcome his approach, must have some concord with humanity. The French, when rearing their worms, call it an "education."

For the right establisment of the industry in this Colony, that it shall have come once more, and now to stay, not only has prejudice to be dispelled, but literally there is an education to be carried on. Men should be sought out who would be fitted to continue the guidance by becoming centres of instruction over wider and wider areas. Profit-making silk-growing is not chance-work any more than it is child's-play. Other things being equal, the man of bright intelligence, of resource, of general information, will make the best profit-making silk-grower. As for the general public, it needs to be educated up to the knowledge that it really knows nothing about commercial silk-growing. Sir A. Cotton tells us that forty years ago an old London wool-sorter made a tour over the sheep stations.

On return to Sydney he said through the press, "one thing is certain, the colonists know nothing on earth about wool." The people who prided themselves on their success and progress in producing wool were offended, then next awoke gradually to the truth of the criticism, and then a new era set in. Sir A. Cotton mentions it for the sake of illustrating that the great body of agriculturists in England know nothing on earth about good farming. We may use it here, with, I fear, less prospect of good result than it had in wool, in its application to silk-growing. Just as the agriculturists there would listen with wonder and pleasure to, and approve of, the authentic report of a return from the soil in sevenfold quantity, through deep cultivation, and then go on in their own old way, ploughing their regular five inches and no more, so do men here, in whom is again awakened an interest in silk, approve of the necessity of planting mulberry trees by the million as the *sine qua non*, and then go on their way, hoping that somehow or other —the how not being worth thinking about—silk will come to be a staple grown here as important as is that of wool

A new way, however, is not always the right way. A remarkable instance in point comes now before us. It was 1879 that a large manufacturing firm in Bradford, Yorkshire—Lister & Co.—began to move towards the obtaining for the British manufacturing districts and themselves, silk of their own growing from India. In 1883 a grant of 3,218 acres was made to them by the Indian Government, conditional on their producing from it 2,500 lb. of cocoons in any one year within the next ten years. There was unlimited capital at the back, and one can imagine that everything was bound to go well. But it went all the other way. In a letter from Mr. Lister to the President of the Silk Association of Great Britain, June, 1888, he told him that his experiments had cost him £50,000, and though he regarded the money as practically wasted, he was now at last about to have a splendid year. We find elsewhere the detail showing what the splendid year proved to be. The manager used 150 ounces of eggs, and obtained 1,625 lb. of cocoons. From the same quantity of eggs, high-class Italian work would obtain 22,500 lb. of cocoons. Mr. Lister's result certainly was "splendid" compared with that of four years previously. Then 320 ounces of eggs were used, and the produce was somewhat less than half the 1,625 lb. It is worth our while to try and get to the bottom of this astounding procedure. If Sir A. Cotton shows us the marvels accomplished by deep cultivation, and can explain them by science, these experiments show us the opposite results of a cultivation which seems to have been unscientific throughout. The report of the Government expert sent to inspect generally the silk production of India in 1890 tells us what is almost incredible. Of the 900 acres planted, he says, 600 are planted with a late variety which is practically useless, as they begin to leaf in April, when it is so hot that the rearing should be over; the other 300 are planted too thick (the object being to keep down the jungle [!]) to have any chance of producing full-formed leaves. Mr. Lister's grand object was to rear the *Bombyx mori*, or European annual worm, on the leaf of the Bengal mulberry, which is the proper food of the multivoltine worm of Bengal, a shrub grown in thousands to the acre, which has to be "kept down to the height of beans or lucerne," because it dies out if allowed to grow tall. This purpose to put *Bombyx mori* on to Bengal mulberry must be admitted to be a great mistake at the outset. It is the more remarkable because a veteran observer and careful experimenter in silk-growing, Captain Hutton, has recorded his matured opinion towards the end of his career, after being a foremost man in Indian silk matters through more than a generation: "I should be very much tempted to begin my experiments again, but with *Bombyx* I will have

no more to do. Nothing can be gained by introducing the *Bombyces* of China (which is a colder country) into localities where experience has shown us that they cannot thrive. If the cultivation of silk in India is to be extended in earnest, it is with the wild worms that the game must be played."

The second mistake arose from the misfortune of having too much capital. Capital, in France, was a scourge to the industry, when it sought to conduct rearings on a gigantic scale in one single large building; and Pasteur's investigations concentred in the advice that they must go back to the cottage cultivation, the *petite culture*, if they wanted to keep free from disease in the future. They should have kept to the old French proverb, "*petites magnaneries, grandes filatures.*" Mr. Lister's tendency was to fall into the same error as the French capitalist. "Give me a fulcrum," said the enthusiastic British capitalist, "and I will move the sericultural world." In the same letter he said, "The whole art and mystery consists in having (1) sound seed, (2) air, space, and cleanliness, (3) regular feeding, (4) suitable rearing-houses (all very good, so far); but where do you find such conditions in the native cottage?" True, most true, but was it the remedy for those adverse native conditions to build the numerous large buildings which were to "supersede the unhealthy methods of rearing in vogue in the Punjáb by skilful and rational management," or was this immediately provocative of disease, as had been the case in France? Here comes in its strong bearing on Australia. Australia ought to *start* well in even the minutest particular. All the expensive mistakes made in other countries should be as so much capital introduced into Australia to help it to possess itself of this new source of wealth. The furthest point attained by European and all other experience, practical and theoretical, should be, as we have said, Australia's starting-point. Based on this, results might be attained unheard of as yet anywhere, because, instead of the immovable habits and traditions of the native Hindoo or the European peasant, there could be a newly-educated worker with nothing to unlearn, responsive to every established indication of science.

Mr. Lister's third mistake seems to have been what is sure to be a sore temptation in Australia—impatience for results. Even under the conditions for rapid vegetation in India, the Government expert reports that the Bengal mulberry shrubs should not be stripped for the first five years. Mr. Lister's first big rearing was by stripping three-year-old trees, and, as the quantity in this crop did not give satisfaction, a new manager proposed to get 20 times the quantity the following year. He tried it for three years, stripping every leaf from the plantation, and, of course, having a deficiency of leaves every time, which he tried to meet by sending out carts for 20 miles round, and a quality of leaf quite unsuitable for the voracious stage. We have heard of something like this in Australia, and of the wonderful crops that would follow. At the latest date (April, 1890) the Indian expert reported that the plants of this big plantation, after eight or nine years' growth, "continue sickly and stunted." Exactly so.

It is needless to detail more mistakes. At the rearing season there is a difference of 25° between the day and night temperatures. No provision was made in the big rearing-houses for meeting this serious difficulty in the case of the sensitive *Bombyx mori*. In the importing the European eggs of this species, things somehow did not work. It is a strange contrast to the action in this Colony, as seen in the exhibits referred to in the August article, where every detail of successive stages in the rearing, from the moment the eggs and the worms were skilfully despatched from Booral, seemed to be under Mr. Valder's masterful control. We read of worms

in that latest rearing (1890) hatching out prematurely, and having to be kept alive on lettuce till the mulberry plants should shoot, and that the whole rearing extended over so long a season that it was too cold at the beginning and too hot at the end, and that they had after all to fall back largely on using the eggs of the Bengal multivoltines. In the steamy plains of Bengal, the multivoltine species, *Bombyx crœsi*, suits the indigenous mulberry. They have been mated together for centuries. Bengal silk, which fetches in the market about two-thirds the price of good Chinese or Italian, has its uses in the factories of Europe; and its production had better be left as heretofore in the hands of the natives and the multivoltine worms, with their seven or eight or more broods in a year. The trend of the Indian export silk trade is more and more, as Hutton predicted, towards the using of the wild silks and waste; and it may surprise some readers to be told that India *imports* more raw, *i.e.*, reeled mulberry silk than she exports. Up to 1857 nearly all her export was reeled mulberry silk. Then began a marked change through the discovery that waste and wild silk could be utilised in Europe; since then the export of the mulberry silk has dwindled to one-fourth the previous average, though the average has been fairly well kept up in quantity, but not in values, by the increasing export of waste and wild. India imports, *via* Bombay, raw silk produced by *Bombyx mori*; this raw silk is chiefly consumed in Bengal and the Punjáb, the very provinces which send their own production of raw silk from *Bombyx crœsi* and a dozen other species, *via* Calcutta, to the markets of Europe. When will Australia, from its suitableness to rear *Bombyx mori*, send its fine raw silk or its cocoons—they can take either—to the ready market in India?

Enough has been said to prove that there will be all the difference in the world, in relation to silk being a permanent and great and profitable industry in Australia, according as the start is made well or ill. For some time to come our talk should be, not about growing silk, but of the necessity, first of all, of having trees of the right kind growing by the million. About the same year that Mr. Lister appropriated part of his fortune to the growing of silk in order to help to meet the world's great demand, another man in another country appropriated part of his to the benefiting of his country in the same way. This man achieved a signal success. His first care was to have an abundant supply of the necessary leaf-food. Beginning by acting as this foreigner did;—proceeding then in a way almost the reverse of the way followed by the Englishman, namely, by (1) wise choice of that land only which is suited for European mulberry; (2) wise choice of that description of mulberry which is most suited for the particular locality; (3) placing the trees under skilled attention and pruning, and not once stripping them of their lung power during a certain term of years fixed according to the locality; (4) keeping strictly to the annual worm, *Bombyx mori*, and having of it an acclimatised breed distinctly known as the Australian, but (5) getting, when the trees are of age to be used, successive crops in a single year from this annual worm by (*a*) the pruning of the plantation in sections each timed to follow on successively in supplying leaf in prime condition, or (*b*) having in the one plantation distinct later varieties, as the case may be best; (6) having the rearing-shed complete in regard to air, space, cleanliness, ventilation, and uniformity of temperature, and fitted to rear easily not more than 2 oz. of eggs at a time; (7) desiccating the cocoons by the latest approved scientific methods; and (8) by the most skilful growers (and only such) being ever on the look-out for selections at the breeding time, in full faith in the possibility of improving the breed to an indefinite extent, and thereby raising the quality of the produce;—beginning thus,

proceeding thus, there seems no reason why Australia should not become, in less than a generation, pre-eminent as one of the largest and finest silk-growing countries in the world.

I have referred to the desiccation of the cocoons. There will be no surer sign that silk-growing has come to stay than that growers, instead of being found here and there, isolated and struggling on in different districts, are banded together in clusters within, say, a radius of 5 or 6 miles of each other in each of the separate districts. It would be most desirable, and far more economical for all, if to a central point in each district, all could send their cocoons to be properly desiccated. It was once my privilege, at the invitation of Dr. Creed, to see the engine-worked revolving cylinder at the Quarantine Station, in which clothes were disinfected by superheated steam so rapidly that, as was said, when the denuded man got round to the other end of the building, he found his clothes all waiting for him, sweet and clean. It had occurred to Dr. Creed that a modified arrangement of this revolving cylinder might be adapted to the desiccation of cocoons on a large scale. The idea seemed a most admirable one. The building erected for this purpose forms with me part of a scheme. Personally, I may perhaps be permitted to say here, I hold that there is small hope of New South Wales becoming permanently a silk-growing country worthy of the name, unless the State bridges over the initial difficulty of the first eight or ten years. This interval is the insurmountable obstacle. It could be bridged over by the State undertaking the planting the trees in quantity in the suitable districts, and having them duly cared for until they were fit for use,—meanwhile they would have an educating influence as a great object-lesson,—after which, the use of them could be offered on lease to competition, and all beyond this initiatory State action be left to private enterprise; in which case, as I believe, the State would eventually get back all its outlay and more. If this were done, it would be best for the State to own the building central to each district, and my notion is, that this building should also have store room, where each grower's lot of cocoons, after desiccation, might remain for a certain time, whence, by private treaty or by auction in open market on appointed days during the season, the buyer could remove them direct; it being, of course, at the grower's option to take them back at once to his own place after desiccation. A small graduated fee paid by the grower for desiccation and store room would make the building self-supporting. And further, assuming that the industry has thus become so far established that there is an ever enlarging desire on the part of neighbouring settlers to add silk-growing to their other occupations on the soil, the central building could become a recognised depôt where good advice, sound *graine*, and suitable plants and seeds were to be obtained.

Poultry.

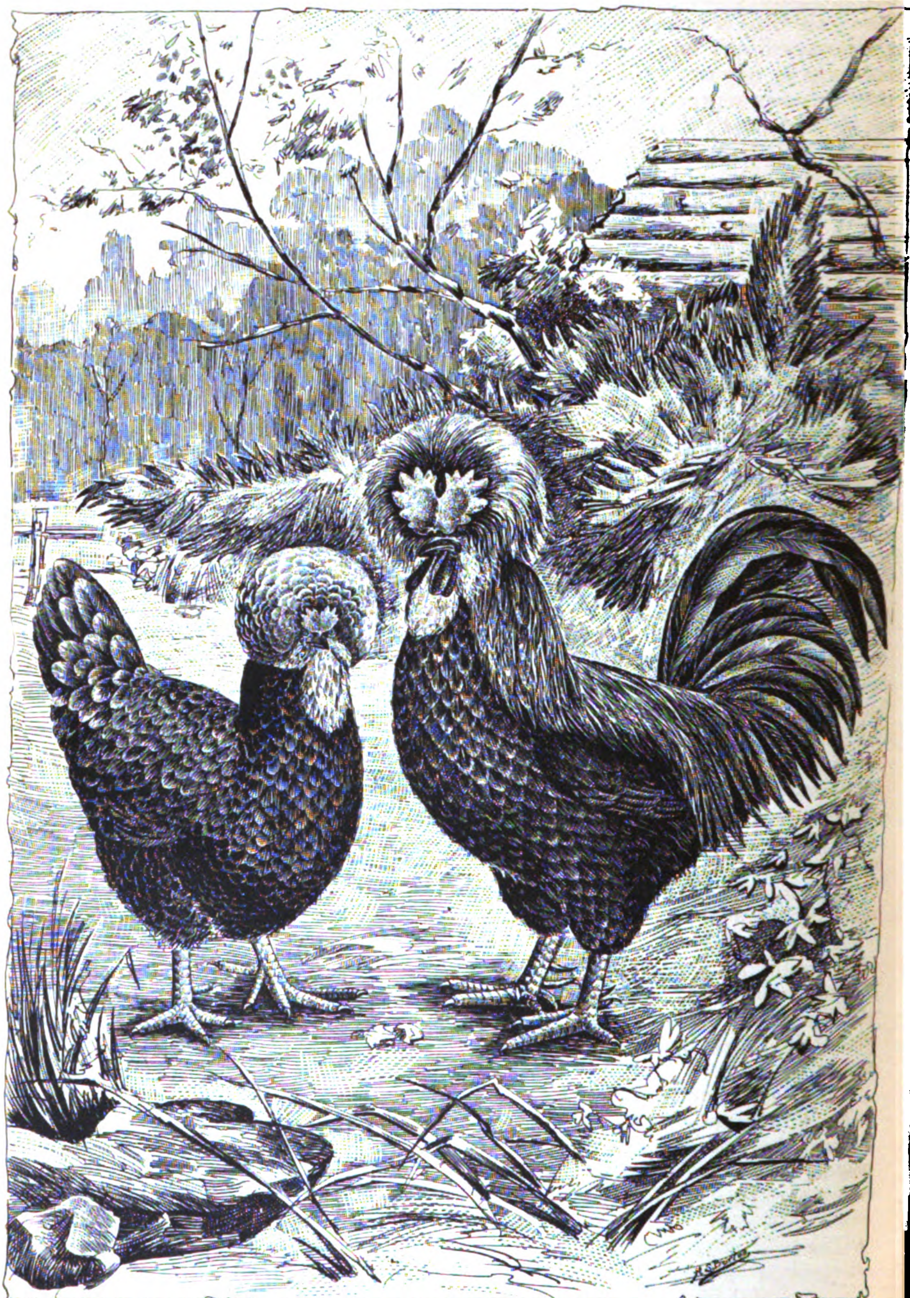
By S. GRAY,
Sub-Editor.

The Houdan.

Having now devoted considerable space to the various English and American breeds, I propose to vary the monotony by dealing with one of the best known of the French. It may be well to mention that the French farmers and peasants are very large breeders of essentially useful birds, and that the "fancy," as understood in English-speaking countries, is conspicuous by its absence. The French not only keep their home markets fully supplied, and poultry is a very important item in French cookery, but they monopolise a very large portion of the English trade, particularly in eggs. The bulk of the eggs sold in London come from France and Belgium.

The Houdan is known amongst English breeders as the "French Dorking," and it is probably a cross between the English Dorking and the Polish. In any case it is an excellent table bird, a good layer, and, as is the case with most crosses, a very hardy bird. It is somewhat of the Dorking shape, possessing also the fifth toe, and has the Polish crest and muff. Curiously enough it did not become a show bird of any consequence until taken in hand by the English breeders. So far, while emphasising the prominent points, I do not think they have to any great extent detracted from its useful qualities. A somewhat pointed proof of this lack of careful French breeding occurred to myself. Having decided to import a trio of Houdans, I thought it best to apply to France, as being the home of the breed, in order to get the correct thing. I entered into correspondence with the Director of a Government Zoological Garden in France, and in due course my trio arrived. I thought, upon seeing them, that they did not appear such fine birds as I had seen in Sydney shows, and with a view to settling the point I asked a well-known and very successful New South Wales breeder (Mr. Hemsworth, of Parramatta) to quote me a price for one of them. He promptly told me that he would not have one of them in his yards, and having seen some of his stock I am sure he was quite right. My advice, therefore, to such of my readers as should decide to try some is to buy in New South Wales.

The Houdan is essentially a farmer's fowl. It is a good layer, an excellent table bird, very hardy, a good forager, and the chicks feather like magic and require very little attention. It is, however, a non-sitter, and, therefore, some hens of a sitting breed are necessary during the season. I am of opinion that this is a breed which could be multiplied with the aid of an incubator and some foster mothers, and thus the keeping of any other breed would be unnecessary. I should be glad if any breeders would let me have their experience on this point. Like the Dorking, though not to so great an extent, it is subject to "bumble foot," caused probably by the presence of



HOUDANS.

the fifth toe. A fair weight is 8 to 9 lb. for the cock, and 6 to 7 lb. for the hen. Heavier weights are obtained, but are not advisable. They are generally the result of further crossing with Dorkings, and tend to spoil the real Houdan character, which is lighter and more active than the Dorking. The cock bird is peculiarly prepotent, and will make his influence felt with an extraordinary number of hens. For this reason it is better, when careful breeding is required, to keep only the one breed, or, at any rate, to keep other breeds separate. The Houdan does fairly well in confinement, and will doubtless be most successful on well-drained soils.

The following description of the breed is by Mr. R. B. Wood, of Uttoxeter (Eng.), and is taken from Lewis Wright's *Book of Poultry*:—

"I have now kept Houdans for nearly seven years, and can safely say that I have not found them fall off in any way, but quite the contrary. I find them good layers of fine eggs, and as table fowls not, in my opinion, to be surpassed. They are very hardy as chickens, feathering and maturing in a much shorter time than either Brahmas or Cochins. I consider them a very valuable breed for anyone to keep when non-sitters are required, as it is very rare for them to show the least tendency to incubate. It is also worth remark that though good foragers when at liberty, they are easily kept in bounds, being very different to Hamburghs or Games in this respect; and they will bear confinement as well as most breeds.

"My idea of a good Houdan cock is as follows:—He should be as large as possible, and carry himself well. The comb should be good and characteristic; not of the Creve-cœur type, but flat at the sides, with something like a bunch of coral in the centre. It is, however, very difficult, if not impossible, at present, to breed to any *exact* standard in this particular point. The wattles should be long; the crest large, composed of feathers similar to those of the hackle, and inclining rather backwards so as not to hide the comb; the muffling full, so as to hide the face. The colour should be a rich black and white, as evenly marked as possible, especially on the breast; but most birds have more or less straw-coloured feathers in crest, hackle, and saddle, and I do not consider them any great drawback, although I would prefer pure black and white if the bird were equal in other points. The tail should be dark in colour, well sickled, and carried erect. The legs are light in colour, or black and white [we should describe the colour ourselves as pearly-white mottled with black]; the fifth toe well developed.

"The hen should be large, with a *small* coral-like comb: crest and muffling large, and as full as possible; colour pure black and white, as evenly broken as can be, the markings being rather small. The legs are similar to those of the cock. Red feathers are inadmissible in both sexes.

"To breed Houdans, if the hens are light in colour, a dark cock or cockerell should be selected; but I prefer to mate dark hens with a cock or cockerell rather lighter, and from birds so mated I have bred beautiful birds of both sexes. I am inclined to think the crest comes from the hen, and would, therefore, be more particular in choosing large-crested hens than cocks."

Our illustration is from a drawing by our artist of two birds belonging to Mr. C. Hemsworth, of May's Hill, Parramatta.

The other breeders of Houdans in New South Wales, so far as I am able to ascertain their names, are:—Mr. P. S. Grunsell, of North Goulburn; Mr. Thos. Hall, Fairfield; Mrs. W. H. Webb, Bathurst.

Practical Vegetable Growing.

Directions for the Month of December.

This is one of the most trying months of the year for gardens, and there is often some difficulty experienced in raising good vegetables, especially when dry, hot winds occur. There should be no difficulty for farmers and others who keep stock to provide a plentiful supply of material suitable for a mulch in the droppings of animals, straw, and dead leaves. These should be gathered together in a heap, and allowed to rot, or partially rot. This can be done from time to time when convenient. When hot, dry weather is likely to occur a heavy dressing should be spread all over the ground amongst the vegetables. Stirring up the soil frequently, has to a great extent the same effect as a mulch—that is, to prevent soil-moisture from evaporating.

In the moist, semi-tropical parts of the Colony, the greatest difficulty to contend against is the luxuriant growth of weeds, which, unless removed from amongst the vegetables, soon outgrow and smother them.

The only way to check the weeds is to remove them whilst they are young, and constant work is necessary to do this, as anyone who has done any gardening in such a district knows well. However, if a short time daily be given to this work, it is wonderful what can be effected; but it must be borne in mind that one week's inattention may mean a good deal of loss. In the dry districts where but little rain falls, every drop of waste dirty water should be saved, and by using this judiciously, with the assistance of a thick mulch, it may be quite possible to have the luxury of good vegetables, a few, at any rate, to keep the family in health.

It will be necessary to sow a few seeds from time to time. These must be watered after sowing, for moisture is necessary to make them come up, and it would be well to shade slightly and protect the seedlings, or the sun may burn them up. This advice seems simple enough, but it is surprising how much little things, often most necessary, are, either unthought of, or else neglected. It is attention to detail that ensures success in gardening as well as in everything else, so that if a farmer or settler who learns in his vegetable garden the advantages which arise from care and attention to his vegetables, will probably begin to think that similar attention to details on the farm may make him more prosperous than he was before. A man may learn, for one thing, from growing his own vegetables, that a huge amount of produce can be raised from a small area of land; that is, of course, if it be managed properly, and no weeds and no rubbish be allowed to encumber the ground, and as soon as one crop is gathered another must take its place. It should strike any intelligent person that it is infinitely better to raise a large crop on a small area, than a small crop on a large one.

The great secret to learn is, one's strength, and the extent of land one can farm and manage properly. But it is obvious to anyone who travels through the farming districts of this Colony that the secret is rarely learned. It is just the same with the orchards, they are only too frequently too large to be properly managed by those who plant them.

Beans, French or Kidney.—As soon as old plants have ceased to produce beans they should be cleared away and the ground can then be used for some other kind of vegetable after it has been well dug up and manured. The beans should be picked before they are nearly full grown, and then plants will continue to bear several crops. If any beans are allowed to ripen, the plants will cease to bear and will gradually die away. Seed should be sown to keep up a supply of this vegetable. If the soil is dry the bean seeds should be soaked with water after they have been sown in the rows and before the soil is covered over them. It would be advisable to spread a mulch or covering of horse or cow dung over the rows when the seeds have been sown and covered with soil. When the seedlings appear well above the ground sow a few more rows and so on. The French bean is one of the best and most reliable of vegetables for the summer, and should, therefore, be sown largely as suggested, so that a constant supply may be kept going. The tall-growing varieties may be sown, if preferred, but then more labour will be required in consequence of sticks or supports being necessary for the plants to climb over. But at the same time it is possible to keep the plants somewhat dwarf by cutting them back.

Brocoli.—This plant is almost the same as the cauliflower, and is well worth growing. A small quantity of seed may be sown, either in boxes or a seed-bed, which should be shaded and watered. When the plants are strong and hardy they should be planted out, about 3 or 4 inches apart, in a small, well-prepared bed, in order that they may develop well for further planting out in their permanent places.

Borecole or Kale.—Sow a little seed, and shade and water as suggested for brocoli.

Cabbage.—Sow a small quantity of seed and treat as above. Strong young seedlings may be planted out to some well-prepared ground. The richer the soil the wider apart they may be planted—say from 2 feet 6 inches to 3 feet. It may be advisable to give cabbages frequent applications of liquid manure during this time of year, for they should be kept growing vigorously, and they are better able then, amongst other advantages, to withstand the attacks of aphis and caterpillars, which often destroy whole crops during the summer.

Cauliflower.—Sow a small quantity of seed and treat them as recommended for brocoli.

Cucumber.—Seed may be sown if more plants are required. The fruit should now be available in quantity. Plants coming on slowly will be improved considerably if supplied with occasional applications of liquid manure, made from horse, cow, or fowl dung, or all three mixed together. It should not be allowed to flow over the leaves when applied.

Celery.—A little seed may be sown during the month so as to have a supply available if required. There is no need to waste seed, for not many plants will be required. Celery is not only a wholesome useful vegetable for salads, but is excellent when boiled. A few plants should be put out occasionally from the seed-bed to ground that has been heavily manured. A few well-grown plants may be earthed up to blanch their stems as required. The application of liquid manure, occasionally, will be of advantage.

Cress and Mustard.—Sow a little seed occasionally to keep up a supply. Make the ground rich with well-rotted manure.

Egg Plant.—A little seed may be sown, if plants are required.

Maize, Sugar or Sweet.—This is but seldom used in the Colony as a vegetable, but it is well deserving of a trial. The ordinary kinds of maize are not nearly so good for table use as the Sweet varieties. The growing of maize is so well-known in the localities for which it is suitable that there is no need to enter into detail here.

Onion.—Sow a small quantity of seed in drills. Attend carefully to growing plants, and keep them quite free from weeds.

Parsley.—If there are no plants in the garden sow a little seed, for no garden should be without a few plants.

Peas.—In the cool parts of the Colony sow a few peas, and keep the ground between the rows well cultivated in order to retain moisture and destroy weeds.

Pumpkin.—Seed may be sown if more plants are needed, or if the supply from plants already raised does not seem likely to be sufficient for requirements.

Radish.—A little seed may be sown occasionally to keep up a supply.

Spinach.—Sow a little seed of this useful vegetable, which is not grown so frequently as it should be.

Tomato.—There should be an abundance of the fruit of this vegetable in all kitchen gardens at this season of the year. A great deal is generally wasted and allowed to rot, when it could be preserved and made into sauces and so on. Seed may be sown if any more plants are required.

Turnips.—Sow a small quantity of seed in drills, and thin out the plants well when they come up.

Notes on Preservatives for Food.

By F. B. GUTHRIE,
Departmental Chemist.

QUESTIONS are continually directed to the Department as to the advisability or otherwise of using certain chemical substances for preserving perishable food-stuffs, such as milk, butter, meat, tinned fruits, &c. The following notes on some of the most common of these preservative agents may, therefore, be of interest:—

Many of the substances used with this object under their own or a fictitious name are undoubtedly injurious to health when used in any considerable quantity.

Such are boric acid and borates (borax), salicylic acid and its compounds, sodium fluoride, sulphurous acid and sulphites, and alkaline carbonates.

Most of these substances are capable of acting as preservatives or antiseptics in doses sufficiently small to be practically harmless. At the same time, there is always the risk that prolonged use of small quantities may be just as injurious to the system as an overdose. Again, although the drug in question may have no effect upon a mature person in good health, it may have serious consequences when mixed with the food given to invalids or to children. And on this account the addition of such substances, to milk in particular, cannot be viewed too unfavourably.

Their use is also objectionable for another reason, namely, the temptation they offer to the manufacturer, or to the purveyor, of masking imperfections in the food to which they are added, and of making him careless as to its preparation and the cleanliness of the vessels employed.

There is, further, always the danger that an unintentionally large dose may have been added.

There is always more likelihood of too large a quantity being added than too small a one, and this is especially liable to occur in the case of milk "preserved" with boric acid, the antiseptic action of which substance in milk is very slight.

Against this danger the consumer has no means of guarding, and he is only aware of it when it is too late.

There are, of course, other perfectly harmless preserving substances, such as salt or sugar, though the use of salt in tinned substances is objectionable.

Milk, is the article most frequently bolstered up with chemical preservatives, and the one in which their presence is most particularly objectionable. Milk can be partially sterilized by boiling, or simply heating for 20 minutes at a temperature between 122° and 149° Fahrenheit, immediately closing the vessel in such a manner that air cannot enter. This treatment practically arrests all fermentation, and keeps the milk perfectly sweet until the vessel is opened.

It is, of course, perfectly unobjectionable, and being cheap and simple it seems a pity that it should not be adopted whenever practicable in preference to the addition of chemicals which are, to say the least, of doubtful benefit.

Boric acid and *borax* (which is a sodium salt of boric acid) are amongst the preserving agents most frequently employed. They are extensively used in the preparation of different "patents." For instance, a substance sold under the name of "Barmenite," which was examined some time ago at the Department, proved to be a mixture of borax, boric acid, and common salt.

Similarly, a preparation known as "Preservitas" proved on analysis to be composed of borax, salt, saltpetre, and sugar.

Against the use of such mixtures the same objections hold as against the separate ingredients, with the additional objection that the nature and quantity of the components are kept secret as far as possible.

The action of boric acid and of borax upon the system appear to be very similar. In concentrated solution (4 per cent.) boric acid causes violent pain and diarrhœa. Smaller quantities hinder the absorption of food, a dose of anything over ½ gram (7½ grains) per diem hinders food-absorption. Now, in order to exert any antiseptic action in milk, boric acid must be present in the proportion of 2 grams per litre (about 15 grains to the pint). So that if the milk contains a sufficiency of boric acid to arrest the development of micro-organisms, each pint of it will contain almost double the quantity which suffices to impair the digestion.

Sodium carbonate and *soda* are often added to milk for the sake of masking the acidity or sourness of stale milk. Their use is altogether inexcusable, as they are not preservatives and are exceedingly injurious.

Salicylic acid possesses powerful antiseptic properties. It is used more commonly in alcoholic liquors, such as wine and beer, since it is very sparingly soluble in water, one part of salicylic acid requiring 400 parts of water for its solution. Its action on the system is to cause fullness in the head when taken in moderate doses. Larger doses produce headaches, affect the sight and hearing, and induce excessive sweating. Its action on the kidneys is especially marked, and its use particularly harmful to sufferers from kidney complaints. In very dilute solution it appears to be harmless, and owing to its strong antiseptic properties there is no reason to employ it in anything like dangerous quantities. One-twentieth of a gram is said to be sufficient to preserve 1 litre of beer (that is about 4 grains per gallon), whereas about 30 grains per gallon have been proved to be without effect upon the health. On this account it is the least objectionable of the preservatives under discussion. Nevertheless, its use in both France and Germany is forbidden, as is also the use of borax and boric acid. In France the prohibition is absolute, the reason given being that, although its use in small quantities would probably not injure healthy people, it may nevertheless produce decided disorders of health in the old, or in those who have a tendency to diseased kidneys or dyspepsia.

Sulphurous acid, sodium sulphite, sulphite of lime, or sulphur fumes, are employed more especially in the preparation of the casks for holding wine. When properly managed there is no danger of more than traces of the acid getting into the wine, and in such small quantities it is harmless. One-half grain sulphurous acid, by weight, is sufficient to prevent the ordinary diseases of wine in every gallon, and as much as 4 grains per gallon may be taken without danger.

At the same time it must not be forgotten that it is a poison, and although there is no likelihood of the practice of sulphuring wines being discontinued, it is as well to remember that it is not unattended with risk.

Diarrhœa and vomiting are the preliminary effects of its use in excessive quantities. The use of sulphurous acid and its compounds are also prohibited in France and Germany.

The question of "plastering" wines also comes under the same heading. In France the maximum quantity of sulphate of potash permissible in wine offered for sale is 120 grains per gallon, whether such addition has been made by plastering the must or by adding plaster or sulphuric acid to the wine.

Enough has been said to show that the addition of any of the substances enumerated above to any article of food is to be viewed with distrust, such additions not being harmless in themselves, and serving often to hide imperfections in the food; further, that substances, the nature of which is unknown (all secret preparations), should not be tolerated on any account. One such "secret" preservative preparation which has come under my notice, and is in use here, professes to be a compound which has "defied analysis." This, if it were true, instead of counting in its favour (as the proprietors evidently intend it should), ought to be sufficient to render its use illegal, for if it cannot be analysed, there is no means of pronouncing beforehand either upon its efficiency or its harmlessness. It should be impossible to expose for sale, or to use, any addition to food without a proper guarantee of the exact nature and proportion of its ingredients, and it is preferable to avoid any such addition whatever.

General Notes.

A Timber-tree New for New South Wales.

Under the name of Scaly or Yellow Beech, Mr. Forester G. R. Brown, of Port Macquarie, has sent flowering specimens of *Litsæa* (*Tetranthera*) *reticulata*, Benth.—which is an addition to the recorded plants of the Colony. Mr. Brown states that, like Sassafras, the timber is used for lining-boards.

Logs of this timber were shown by the late Sir William Macarthur at the Paris Exhibition of 1855. One log was numbered 24, and the following description given:—"*Cryptocarya obovata*" (the shapes of the leaves of *Litsæa reticulata* and of *Cryptocarya obovata* are not unlike—J.H.M.), "beautiful small tree, wood tolerably close-grained, but soft. Diameter, 18–30 inches; height, 60–90 feet."

The second log bore the number 192, and the following description:—"*Crytocarya sp.*, aboriginal name Myndee, local name White Sycamore. A handsome tree (doubtful if not the same as No. 24), wood fine-grained and soft. Diameter, 12–54 inches; height, 50–120 feet."

Bentham, in the *Flora Australiensis* (v. 306), refers both these logs to *Tetranthera* (*Litsæa*) *reticulata*, and he had Sir William Macarthur's herbarium specimens before him.

But in the *Flora Australiensis* the tree is referred to Queensland, Bentham remarking that the timbers above referred to probably came from Brisbane River (Queensland), whereas they came from Brisbane Water (New South Wales), 500 miles to the south. Owing to this typographical or geographical error, the species has continued to be recorded only as a Queensland tree to this very day. *Litsæa* belongs to the Laurel family (*Laurineæ*).

Aboriginal Names of Plants, Lachlan District.

Following are the aboriginal names of some plants in the Lachlan district, as supplied by Mr. Forester Kidston:—

"Baringa," or "Golden Wattle"—*Acacia decora*, Reichb.
"Weeder"—*Acacia cyperophylla*, F. v. M.
"Toolia"—*Acacia juncifolia*, Benth.
"Narka"—*Acacia colletioides*, A. Cunn.
"Bowra" or "Hop-bush"—*Dodonæa lobulata*, F. v. M.
"Maranoonba," or "Chamomile bush"—*Olearia pimelioides*, Benth.

Mr. Kidston also gives a few other names which have been frequently published.

The Star Thistle (*Centaurea calcitrapa*).

In our issue of July last it was mentioned incidentally that this thistle was new to the Bathurst district. The statement was made on the authority of a resident who has since found that he meant quite another variety. Mr. Allison, of Eglinton, near Bathurst, has written to say that he has known the star thistle in the Bathurst district for the last eighteen years, and, from information from other sources we are enabled to confirm this, and, therefore, desire to correct our previous announcement.

Pants in Swine.

Mr. Stephen Pegum, of Summer Hill Farm, Upper Burrangong, writes as follows:—"I read with much interest the several very able and interesting articles on tuberculosis, &c., in cattle and 'pants,' or contagious pneumonia, in swine, in the June number of the *Gazette*. Mr. Stanley and the other gentlemen associated with him in conducting the investigations on these diseases are to congratulated, as the result of their valuable labours is alike creditable to the Board of Health and the Colony generally, for there is evidence in what is already achieved, that much benefit may follow from the important discoveries resulting from these investigations.

"With reference to 'pants,' or contagious pneumonia, in swine, as there appears from the report 'to be, at present, no known remedy' for 'pants,' I beg to say that I have several times, even in apparently very bad cases, found sulphur a specific for 'pants,' but the treatment must be prompt, thorough, and continuous.

"In making this statement, I may add that I do not pretend to any intuition regarding the nature of disease or inclination to investigate it; on the contrary, I am rather deficient in the one and averse to the other. Nevertheless, I hope the treatment may be tested, and the result published, for 'tis possible, if sulphur be an antidote for the bacillus of pneumonia in swine (since we now know that a special bacillus is the cause of that disease), it may also be a remedy for such diseases of the lungs in all animals, even in man himself, for we know that a bacillus is present also in that form of lung disease in man known as consumption.

"I shall not refer to the symptoms of the disease, they are easily discerned and well known. Immediately the disease appears take the pig and confine him away from the piggeries and the other animals in an enclosure having a warm shed, with plenty nice, warm bedding. Give him no water or food (indeed, he will not look at solid food of any kind), but give him milk or gruel with plenty of sulphur in it. Let him have nothing whatever for three days but this sulphur mixture, as much as he will. At the end of three days the 'pants' will have disappeared, and he will eat solid food, but give him none. He is not yet cured. Continue the same sulphur treatment for three days more with a lessened quantity of sulphur. On the sixth day you may give him solid food, but continue to give him milk with sulphur in it for his morning's meal till the tenth day. He is now quite well, and may be discharged from the hospital, which should be lime-washed and disinfected when not in use. Under this treatment two things are noticeable, viz., the quantity of sulphur consumed, and the fact that the pig when discharged from the hospital shows no signs of recent illness. He will bathe (a sure sign he is not ill) and eat as well as ever. What I have said presupposes that the animal is of fair average constitution and not inbred. I shall not here refer to the circumstances and conditions which favour the development of 'pants.' Inbreeding and dirty surroundings are responsible for most of the diseases peculiar to pigs; where both of these exist, notwithstanding what I have written, the best cure for 'pants,' or any other contagious disease in swine, is the burning of the piggeries, the erection of new quarters at some distance away, and the starting a fresh herd from sound well-bred stock."

In respect to the above communication Mr. E. Stanley, the Government Veterinarian, says:—"Mr. Pegum's remarks on 'pants' show an intelligent interest in the matter so far as *preventing* the disease. Sulphur is a common

remedy for many swine complaints, but its action is *not* specific in contagious pneumonia. Only a percentage die of this disease; care and good nursing would be equally beneficial without sulphur."

GROUND NUT CAKE.

DECORTICATED ground nut cake (called also earth-nut cake) is a most valuable food, but not largely obtainable in this country. It is eaten with relish by cattle and sheep, having a pleasant, slightly acid taste. In experiments made at Woburn, at the Royal Agricultural Society's Experimental Farm, animals fed with a mixture of this cake, oats and barley, gained per head daily, in the first fifty-two days, 2·42 lb., as against those fed with a similar amount of linseed cake which, in the same space of time, gained 1·76 lb. per head daily. The gain, however, did not continue in the same proportions in two subsequent stages, the albuminous compounds largely increasing in the linseed cake ration as the feed was increased, so the experiment cannot be considered as satisfactory. Had a trial been made with equal quantities of brewers' grains and ground nut cake, as against linseed cake, we should expect a different result, both as regards weight of carcase and cost of feeding.

We give the following analyses of decorticated cake:—

	Tuson.	Voelcker
Water	9·58	10·77
Nitrogenous matter	42·81	47·44
Oil	7·40	8·47
Carbo Hydrates	27·63	22 27
Cellulose	7·87	4 53
Salts	4·71	6·52

Siderius gives the digestibility of decorticated ground nut cake at 90 per cent. to 100 per cent.

As this article is not so widely known in this country as it ought to be, the following extracts from a paper by Professor Robertson may be of interest. The paper was published in the *Journal* of the Royal Agricultural Society, September, 1893, and is entitled, "The Value of Earthnut Cake as a Feeding Material." After stating that he found horses throve best on a mixture of equal weights of this cake and corn, the cake being broken into small pieces and steeped for twenty-four hours in cold water, just sufficient being used to make a stiffish paste, he goes on to say:—

"For fattening cattle I do not know of any better food, in regard alike to its feeding value and to the superior quality of the beef produced. As a food for dairy cows it is admirable, both in increasing the yield of milk and in improving the quality. The butter of cows so fed is firmer than that of cows fed on any of the ordinary oil cakes. A daily allowance of 4 lb. to 6 lb. of the cake, given in the form of paste, and mixed with 2 lb. or 3 lb. of wheat bran, constitutes a perfect food for milch cows. I have had cows so fed for several years, yielding well and breeding regularly. One cow, which, to my knowledge, was fed thus for nearly ten years, enjoyed perfect health, produced a calf every year, and milked exceedingly well. For sheep, there is no better food than earthnut cake; but for these animals I found it best to give the cake dry, and broken into small pieces. Many experiments have proved the value of the cake as a food for pigs. For these animals it was generally made into a thin gruel and given mixed with bran. The same preparation, but in not quite so thin a condition, constitutes a superior food for fattening poultry, though it is not so useful for laying-fowls. The flesh of poultry fattened on the cake is white, fine, and of a superior flavour. It is remarkable that earthnut cake has not made more progress in coming into regular

demand in England. It has long been known and esteemed in the United States. Though the cake is imported into England somewhat extensively from India, it is not ordinarily procurable in our markets, being, it is believed, bought up by the manufacturers of cattle foods, the makers of soaps, &c., on account of the large proportion of useful oil it contains."—(*Mark Lane Express.*)

Experiments with Concentrated Tobacco Juice.

Upon the invitation of the Minister of Agriculture, the director of the National School of Agriculture of Grignon, and Mons. Magnien, gardener in chief of the school, have made some experiments with two forms of concentrated tobacco juice for the destruction of insects. The one is a paste, coming from the Chateauroux manufactory, and the other a liquid from the National manufactory. The action of the two has been equally efficacious against the various insects living upon cultivated plants; the effect of the application is not perceived immediately, but is complete after about about twenty-four hours. The liquor prepared from the paste possesses a poisonous action a little stronger than the liquid; in all cases the leaves of the dressed plants did not suffer. These substances are considered to present the very great advantage of being able to be preserved and exported under good conditions, and completely assure the destruction of insects. There only remains a definite choice to be made and to compare the conditions of length of preservation and the net price.—(*Mark Lane Express.*)

Too Much Work.

On the way to the depôt with butter one winter, I overtook a neighbour with a ton of hay. I asked him what he got for the hay; he said it was a fine article and he got $12, $2 above the market price. I called his attention to the fact that my load, which I was moving along easily with one horse, would bring over $100, while his, heavily loading two horses, would bring only only $12. He acknowledged the advantage I had over him, but said there was too much work to this dairy business for him. Now this is the trouble, too many are trying to escape work, and especially brain work. Dairying, to be carried on successfully, requires brain work as well as muscular work; it requires attention to details. Nothing can be done in a careless or slipshod manner. Regularity and neatness must be stamped upon everything. The cows must be fed and watered at regular intervals and at specified times, so there will be no uneasiness noticed. Milking must be attended to at a specified time and performed with cleanliness and dispatch; the milk must be skimmed and the cream churned at just the right time in order to produce a fine article of butter, and no other kind pays for producing. This course can be pursued just as easily as the opposite if we only make up our minds to it, and lay our plans accordingly.—(O. Meader in *New England Farmer.*)

Gumming in Sugar-cane.

In Vol. IV of the *Agricultural Gazette*, at page 777, there appears an article by Dr. Cobb, in which he describes a disease which he discovered affecting sugar-cane on the Clarence River, and called it "gumming." According to reports received during the present season from Dr. Fuselbach, of Murwillumbah, the disease is also attacking the Singapore variety on the Tweed River in alarming dimensions. This disease is also causing anxiety in the Bundaberg district, Queensland, and specimens of diseased cane have recently been sent to Dr. Cobb from Mauritius.

AGRICULTURAL SOCIETIES SHOWS, 1894.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindale	Jan. 9, 10.
Albion Park A. and H. Association	T. Armstrong ...	„ 17, 18.
Kiama A. and H. Association	J. Somerville ...	„ 25, 26.
Holt-Sutherland H. and I. Society	W. Douglas ...	„ 26.
Wollongong A. and H. Association	J. A. Beatson ...	„ 31, and Feb. 1.
Berry A. and H. Society	A. J. Colley ...	Feb. 6, 7, 8.
Gosford A. H. and I. Association...	H. S. Bevrendge...	„ 9, 10.
Luddenham A. and H. Association	K. Campbell ...	„ 13, 14.
Manning River (Taree) A. and H. Association ...	W. Plummer ...	„ 14, 15.
Lithgow A. and H. Society	M. Asher... ...	„ 15, 16.
Shoalhaven (Nowra) A. and H. Association ...	R. Leeming ...	„ 15, 16.
Ulladulla (Milton) A. Association...	C. A. Cork ...	„ 20, 21.
Marulan P. and H. Society	H. Morrice ...	„ 23.
Kangaroo Valley A. and H. Society	H. Joyce	„ 25, 26.
Candelo A. and H. Association	C. H. Brooks ...	„ 27, 28.
Tumut A. and P. Association	W. H. Bridle ...	„ 27, 28.
Tenterfield P., A., M., and H. Society	J. Harker... ...	„ 27, 28, and Mar. 1.
Port Macquarie A. and H. Society	J. Y. Butler ...	„ 28 and Mar. 1.
Lismore A. and H. Society...	C. S. Connor ...	„ 28 and Mar. 1, 2.
Yass P. and A. Association	B. A. Nicholls ...	Mar. 1, 2.
Berrima District (Moss Vale) A., H., and I. Society	J. Yeo	„ 1, 2, 3.
Nepean District (Penrith) A., H., and I. Society	R. Benaud ...	„ 1, 2, 3.
Robertson Agricultural Society	R. J. Ferguson ...	„ 6, 7.
Uralla P. and A. Association	J. D. Leece ...	„ 6, 7.
Bega A. and P. Association	A. J. Wilson ...	„ 7, 8.
Inverell P. and A. Association	J. M'Ilveen ...	„ 8, 9.
Picton Agricultural Society	G. Bradbury ...	„ 8, 9.
Crookwell A. and P. Association	H. J. Peard ...	„ 8, 9.
Cobargo A. and P. Society...	J. Graham ...	„ 13, 14.
Tumberumba P. and A. Society	W. Willans ...	„ 13, 14.
Glen Innes P., A., and M. Association	J. Denshire ...	„ 14, 15.
Goulburn Agricultural Society	J. J. Roberts ...	„ 15, 16.
Gulgong Agricultural Association...	C. E. Hilton ...	„ 16, 17.
Armidale (Combined Show), A. and P. Association	W. H. Allingham	„ 20, 21, 22.
Taralga A. and P. Association	J. J. Walsh ...	„ 21, 22.
Royal Agricultural Society (Sydney)	F. Webster ...	„ 21 to 27.
Braidwood P. and A. Association...	G. F. Taylor ...	„ 22, 23.
Castle Hill A. and H. Association...	F. H. G. Rogers...	„ 26, 27.
Orange A. and P. Association	J. S. Thomas ...	„ 28, 29.
Walcha P. and A. Association	H. Chapman ...	„ 4, 5.
Lower Clarence (Maclean) Agricultural Society...	J. S. Dunnet ...	„ 4, 5.

Society.	Secretary.	Date.
Camden A., H., and I. Society	W. R. Cowper	Mar. 4, 5.
Gundagai P. and A. Society	W. E. Kyle	„ 5, 6.
Blayney P. and A. Association	G. H. Woolly	„ 5, 6.
Gundaroo P., A., and H. Association	J. Affleck	„ 6.
Namoi (Narrabri) P., A., and H. Association	J. Riddle	„ 11, 12.
Bathurst A., H., and P. Association	W. G. Thompson	April 11, 12, 13.
Clarence (Grafton) P. and A. Society	T. Page	„ 18, 19.
Wellington P. and A. Association	R. Porter	„ 18, 19.
Hunter River (West Maitland) A. and H. Association	W. C. Quinton	„ 18, 19, 20.
Dubbo P., A., and H. Association	G. H. Taylor	„ 24, 25, 26.
Warialda P. and A. Association	W. B. Giddes	„ 25, 26.
Mudgee Agricultural Society	J. M. Cox	„ 26, 27.
Williams River (Dungog) A. and H. Society	....	May 2, 3.
Coonamble P. and A. Association	F. R. Salt	„ 2, 3.
Macleay (Kempsey) A. and H. Association	H. R. Gray	„ 9, 10, 11.
Gwydir (Moree) P. and A. Association	J. G. Cohen	„ 9, 10.
Hawkesbury District (Richmond) A. Association	C. S. Guest	„ 10, 11, 12.
Walgett P., A., and H. Society	P. W. Kenny	„ 15, 16.
Upper Hunter (Muswellbrook) A. and H. Association	E. C. Brecht	„ 16, 17.
Upper Manning (Wingham) A. and H. Society	P. Doust	„ 16, 17, 18.
Central Australia (Bourke) P. Association	J. P. Martin	„ 23, 24.
Cumnock P. and A. Association	W. Newmarch	„ 24.
Brewarrina P. and A. Association	H. L. Cathie	June 5.
Warren P. Association	F. C. Thompson	„ 7, 8.
Cobar P. and A. Association	A. Roxburgh	„ 13, 14.
Nyngan P. and A. Association	E. H. Prince	„ 20, 21.
Urana P. and A. Society	H. A. Hill	July 17, 18.
Deniliquin P. and A. Society	H. J. Wooldridge	„ 19, 2o.
Hornsby, Thornleigh, Pennant Hills, &c., H. Association	H. Epthorp	„ 23, 24.
Riverina (Jerilderie) P. and A. Society	J. Fulton	„ 24, 25.
Hay P. and A. Association	F. W. Blanche	„ 26, 27.
Condobolin A. and P. Society	W. H. Garnsey	„ 31 and Aug. 1.
Narandera P. and A. Association	J. F. Willans	Aug. 1, 2.
Forbes P., A., and H. Association	W. G. Dowling	„ 9, 10.
Corowa P., A., and H. Society	A. A. Piggin	„ 15.
Northern (Singleton) Agricultural Association	C. Poppenhagen	„ 15, 16.
Parkes P., A., and H. Association	H. S. Harwood	„ 15, 16.
Grenfell P. and A. Association	G. Cousins	„ 16, 17.
Horticultural Society of N. S. Wales	E. S. Sautelle	„ 22, 23.
Burrangong (Young) P. and A. Association	C. Wright	„ 23, 24.
Moama A. and P. Association	C. L. Blair	Sept. 4, 5.
Cowra P., A., and H. Association	S. Wright	„ 5, 6.
Murrumbidgee P. and A. Association (Wagga)	H. T. Davidson	„ 5, 6.
Queanbeyan P. and A. Society	E. C. Harris	„ 11, 12.
Burrowa P., A., and H. Association	J. F. Clifford	„ 13, 14.
Albury P. and A. Association	G. E. Mackay	„ 13, 14.
Burrowa P., A., and H. Association	J. F. Clifford	„ 13, 14.
Junee P. and A. Association	T. C. Humphrys	„ 19, 20.
Upper Manning (Wingham) A. and H. Society	Spring Show	Nov. 2.

SHOW FIXTURES FOR 1895.

Society.	Secretary.	Date.
Dapto A. and H. Society	A.B.Chippindale	January 8, 9
Albion Park A. and H. Society	T. Armstrong	,, 16, 17
Kiama Agricultural Association	J. Somerville	,, 24, 25
Moruya A. and P. Society	J. Kay	,, 29, 30
Lismore A. and H. Society	G. T. Hindmarsh	,, 30, 31
Wollongong A. and H. Association	J. A. Beatson	,, 30, 31
Berry A. and H. Society	A. J. Colley	Feb. 5, 6, 7
Alstonville A. and H. Society	H. R. Elvery	,, 7, 8
Bega A. and P. Society	A. J. Wilson	,, 12, 13
Ulladulla (Milton) A. Association	C. A. Cork	,, 19, 20
Uralla P. and A. Association	J. D. Leece	,, 19, 20
Lithgow A., H., and P. Society	M. Asher	,, 21, 22
Armidale A. and P. Association	W. H. Allingham	,, 26, 27
Tumut A. and P. Association	W. A. Bridle	,, 26, 27
Robertson A. Society	R. J. Ferguson	,, 27, Mar. 1
Camden A. and H. Society	W. R. Cowper	,, 26, 27, 28
Namoi (Narrabri) P., A., and H. Association	J. Riddle	March 5, 6, 7
Tenterfield P. and A. Society	J. Harker	,, 5, 6, 7
Taralga A. and P. Association	J. J. Walsh	,, 6, 7
Macleay A., H., and I. Association	H. R. Gray	,, 6, 7, 8
Berrima District (Moss Vale) A. and H. Society	J. Yeo	,, 8, 9, 10
Walcha P. and A. Association	H. Chapman	,, 13, 14
Cootamundra A., P., H., and I. Association	T. Williams	,, 13, 14
*Inverell P. and A. Association	J. M'Ilveen	,, 14, 15
Glen Innes P., A., and M. Association	J. Denshire	,, 20, 21
Gundagai P., A., H., and I. Association	W. E. Kyle	,, 20, 21
Crookwell A. and P. Association	H. J. Peard	,, 22, 23
Cooma P. and A. Association	W. Madgwick	April 3, 4
Royal Agricultural Society of New South Wales	F. Webster	,, 10 to 16
Castle Hill A. and H. Association	F. H. G. Rogers	,, 15, 16
Warialda P. and A. Association	W. B. Geddes	,, 24, 25
Mudgee A. Society	J. M. Cox	,, 25, 26
Coonamble P. and A. Association	F. R. Salt	May 8, 9
Gwydir P. and A. Association (Moree)	J. G. Cohen	,, 8, 9

* District National Prizes to be offered.

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[2 plates.]

Claroson, 5.

Defiance, 2.

Pringle's Defiance is a hardy, prolific, latish wheat, resistant to rust, and yielding a grain almost identical with that of Blount's Lambrigg. It stools freely, and thrives—that is, yields some sort of a crop,—even on rather poor land and with poor treatment. Wheats answering this description are grown in all the Australian colonies, the most prominent of which is Smith's Nonpareil.

Prominent Characteristics.—Medium height, strong whitish straw, bald whitish or yellow heads, amber grain of medium size or small, late, productive, rust-resistant, somewhat liable to shell.

Early Para, 5.

Early Para is among the earlier of the prolific and rust-escaping varieties. It stools well but does not creep, and its grain is of very good quality. If only by selection the straw could be strenghtened—a matter of no great difficulty, we believe—this variety would eclipse many of the sorts now grown. If sown early, it ripens its grain before the warm moist spells likely to occur in late mid-summer. This variety originated, we believe, in South Australia, and for a season or two it was much spoken of as the coming variety. It has been tried in all the Australian colonies. It is related to King's Jubilee.

Prominent Characteristics.—Medium height, weak and brittle white straw, bald whitish heads, yellowish grain of medium size and good quality, very early, rust-liable, but escaping if sown at the proper season, prolific, little liable to shell.

Farmer's Friend, 25.

Grosse's Prolific, 5.

Grosse's Prolific may be called an abbreviated purple-straw wheat. Except in form it completely resembles the purple straws, being delicate, and very liable to rust, but a great yielder in a good season, and on good well-cultivated land. Though the ears are short, they contain a surprising amount of grain. This wheat will stand gales without breaking down, and without much shelling. The grain is of very good milling quality, from the Australian point of view.

Prominent Characteristics.—Rather short, strong stiff purple straw, short bald club-shaped ears, large yellow grain of good quality, rather early, productive, rust-liable, does not shell.

Hudson's Early Purple Straw, 40.

This will not do very well in an adverse season or on badly drained ground. It is very liable to rust, but being a very early wheat, it will usually ripen its grain early enough to escape the bad effects of the warm moist weather likely to occur in October and November. If sown early it will ripen in November, if the season is fairly good. Hudson's Early Purple Straw is a very prolific wheat, and is beyond question one of the very best of the purple straw sorts. It is not now grown to any extent here, but it is sure to come into favour as soon as it can be distributed and becomes known. Steer's Early Purple Straw, Farmer's Friend, Fillbag, Rattling Tom, Red Straw, Northern Champion, Jacinth, and possibly Red Tuscan, are different strains of purple Straw, very similar in form to Hudson's Early Purple Straw, and equally rust-liable, but for the most part are later. All are prolific.

Prominent Characteristics.—Tall, strong, purple straw, large bald rosy heads, large yellow grain of superior quality, quite early, very productive, very rust-liable, not liable to shell. Yields good quantity of flour of good colour and fairly strong, but low percentage of gluten.

Improved Fife, 5.

Fair milling wheat, yielding very strong flour of good colour and high percentage of gluten.

Improved Fife is a hardy rust-resistant late sort—a typical Fife; it stools well, is fairly prolific, and yields a grain of good quality, rich in gluten, and valued in America by the millers. Where lateness is not an objection, it is worthy of attention. It must be sown early,

Prominent Characteristics.—Medium height, strong yellow straw, bald, rosy ears, small yellowish grain, valued in America by millers, late, fairly productive, somewhat liable to shell, rust-resistant

King's Jubilee, 5.

This is one of the very earliest varieties. It stools fairly well, and yields well on good soil. The structure or composition of its tissues renders all its parts weak and brittle. It is very liable to rust, but if sown early it ripens before much damage is done. This wheat will never give satisfaction except in situations protected from strong winds, and where there are no heavy downpours, as both these agencies cause it to lodge dreadfully. It will also lodge from its own weight on land rich in nitrogen. We believe that by selection this wheat might be improved in respect to its weak straw, and it would then be a very useful variety—one that might possibly do for the warm moist coast districts. We believe King's Jubilee originated in South Australia some years ago. It has not come into general cultivation. Early Baart is one of the parents of this sort.

Prominent Characteristics.—Medium height, weak and brittle straw, bald whitish ears, long whitish grain of medium size and good quality, very early indeed, productive, not liable to shell—in fact, rather difficult to thresh, liable to rust, but frequently escaping on account of earliness.

Blount's Lambrigg, 100.

The Australian Blount's Lambrigg originated with Mr. Wm. Farrer in the Queanbeyan district, New South Wales, from seed imported from America. It has found favour in many parts of the country, and more and more of it is grown from year to year. It has a marked power to resist rust, and is to be highly recommended on that account. The grain is of only fair milling quality. This variety will not do well on naturally wet land, nor in a very wet season, except the drainage be good. It is a late wheat, and must be sown early. It is not suitable for coast districts. It belongs to the Defiance type, and closely resembles Pringle's Defiance and Smith's Nonpareil. It is better suited for export than for the Australian home market.

Prominent Characteristics.—Of medium height, tough straw, bald yellow ears, small flat grain, of fair milling quality, late, good yielder, resistant to rust, not likely to shell.

Leak's, 25.

Leak's is hardy and fairly prolific sort, having the form of the Fife wheats, not early nor yet late, yielding a grain of fair milling quality. It resists rust fairly and is free from shelling, and on these accounts is cultivated to considerable extent in Australia, especially South Australia. It should be sown early. It holds the grain well.

Prominent Characteristics.—Above medium height, yellowish (somewhat brittle) straw, bald yellowish ears, yellowish grain of medium size and fair quality, rather late, fairly productive, fairly resistant to rust, not liable to shell. Grain easy to mill and yielding flour of good colour, fair strength, and a good percentage of gluten.

Marshall's White, 5.

Poland, 10.

This peculiar variety is late, and is useless for flour. It is used for green stock food in some parts of Europe; and this leads us to call attention to it here as being worthy of trial for those purposes in this country. The grain is rich in gluten, and is suitable for macaroni and for stock. It is much grown in North Africa—for instance, in Egypt and Algeria. It is sometimes called Mammoth Rye. It is very resistant to rust.

PROMINENT CHARACTERISTICS.—Very tall, very strong, yellow straw, very large, chaffy, bearded pendulous ears, very large, long, dark grain of very poor milling quality, mid-season, rust resistant, prolific, not liable to shell.

Steinwedel.

The grain of Steinwedel is starchy, but of first-class milling quality from the Australian point of view, and consequently it brings a good price in Australia. Owing to its earliness, this variety escapes rust in many districts if it is sown early and well on good land. It is unsuitable for coast regions. This sort must be harvested promptly whenever it becomes ripe.

PROMINENT CHARACTERISTICS.—Tall, strong, purple straw, large, bald, rosy ears, large yellow grain of very good quality, early, very productive, very rust-liable, shells badly.

Sicilian Square-headed Red, 5.

Hard to mill. Flour yellow with high percentage of gluten.

Velvet Pearl, 5.

Velvet pearl is a very early wheat, giving a grain of very good milling quality, from the Australian point of view, but is only a fairly good yielder, as it stools rather sparingly in an upright manner. It will stand a dry climate, in fact seems particularly suited to such. Although the stools are small, this is easily compensated for by thicker sowing. The bulk of seed per acre is about the same as for other varieties, the seed being small. The wheats, of which this is an example, seem to have come into favour in but few parts of the world. The variety known as Red Californian, with velvet chaff, appears to be identical with the present; both resemble Allora Spring, but the latter has not velvet chaff. New Zealand Velvet appears to be the same as Velvet Pearl. A wheat known as Mexican, or Red Mexican, is identical with this. Velvet Pearl is early—early enough, perhaps to be called rust-escaping. It is identical with Blé de Mars de Californie of France. A considerable quantity of it is grown in South Australia and New Zealand.

PROMINENT CHARACTERISTICS.—Medium height, short, bald, velvety, red heads, smallish white grain of good quality, very early, fairly good yielder, liable to shell.

White Lammas, 40.

This handsome, freely-stooling, prolific, hardy, mid-season wheat is well known and deservedly popular. It is not resistant to rust, and yields grain of very good quality. It is suitable to any but the coast districts. It varies considerably in form, but is easy to recognise. A wheat we have observed under the name of Scotch Wonder also resembles the White Lammas, but is taller and more slender in all parts, even the grain being proportionately narrower, though equally blunt at both ends. Dallas is a wheat much like White Lammas, but inferior to it. It has slenderer heads with smaller awns. The grain of White Lammas is typical of those held in favour by Australian millers.

PROMINENT CHARACTERISTICS.—Tall, strong straw, bald whitish ears, tips of chaff salmon-coloured, large yellowish grain of good milling quality, mid-season, good yielder, not resistant to rust, does not shell. Very easy to mill, and yielding fairly strong flour of good colour, and a good percentage of gluten.

White Tuscan, 5.

White Velvet, 30.

It is quite liable to rust, but is rather early, and may escape rust on that account. It stools fairly well, and as the grain is small, it requires less bulk of seed per acre than the larger grained sorts. Our impression is that it does best in limestone country. It stools well, but does not creep.

PROMINENT CHARACTERISTICS.—Medium height, white straw of medium strength, bald, white, velvety heads, beautiful small, white, plump grain, of excellent milling quality; moderately early, productive, rust-liable, not liable to shell.

I offer also any of the following numerous sorts, which are the original stock from which selections were made. This gives every farmer a chance to try any wheat known in this country, or, roughly speaking, in the whole world.

1A1, 301.
Adamant, 164.
Advance, 192.
African, 252.
Agate, 381.
Algerian, 317.
Algerian Pearl, 195.
Allora Spring, 1042-1047.
Allora Spring, 1036-1041.
Allora Spring, 23.
Altkirch, 152.
American Purple Straw, 378.
Amethyst, 276.
Anglo-Canadian x Improved Fife x White Naples, 15 D.—x breds.
Anglo-Canadian x Improved Fife x White Naples, 11 D.—x breds.
Autumn Saumur, 270.
Anderson's R. R., 46.
Andriola Amber, 4.
Andros, 205.
Anglo-Australian, 5.
Annis, 260.
Archer's Prolific, 4C3 B.
Atlanti, 2?6.
Australian Amber, 279.
Australian Bearded Wheat, from P. Murdock, Port Germain, S.A., 8 A.
Australian Club, 400.
Australian Glory, 130.
Australian Glory, 342.
Australian Poulard, 316.
Australian R. R., 45.
Australian Talavera, 945-965.
Australian Talavera, 426-431.
Australian Wonder, 91.
Australian Wonder, 286.

Bailey, 397.
Banater, 104.
Bancroft, 224.
Bancroft Improved, 225.
Banham's Browick, 44.
Barbu à gros grain, 111

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CONTENTS.

Useful Australian Plants.

By J. H. MAIDEN,
Consulting Botanist.

No. 15. Spiny Rolling Grass: A Sandstay.

(*Spinifex hirsutus*, Labill.)

Vernacular Name.—"Spiny Rolling Grass" appears to be perhaps the best name for this grass, but it is by no means in universal use, many people simply calling it "Sandstay" or "Sea-coast Grass."

It is not to be confused with the so-called "Spinifexes" of the interior, which are, botanically, *Triodia.* They are far more prickly, and hence deserve the name of *Spinifex* better than the plants included in that genus. The genera *Triodia* and *Spinifex* are not closely related to each other.

Botanical Name—*Spinifex*, from the Latin *spina*, a thorn or prickle, in allusion to the spinous rachis of the male spikelets. *Hirsutus*, hairy, in allusion to the general appearance of the plant.

Botanical description.—Genus *Spinifex* (*Flora Australiensis*, vol. VII, p. 503).

Spikelets.—Diœcious*, spicate, or solitary on partial rachises, collected in dense globular heads with a bract under each rachis.

Male plant: Spikelets.—Usually several to each bract, spicate or clustered, two-flowered.

Glumes.—Four, nearly similar, two outer empty ones, sometimes smaller, sometimes larger than the two-flowering ones. A perfect *palea* and three *stamens* within each flowering one.

Fertile plant: Spikelets.—Solitary within each bract at the base of a partial rachis, with one female or hermaphrodite flower, and an imperfect or rudimentary or sometimes a male flower below it.

Glumes.—Four, as in the males, the three with a more or less developed *palea*, and sometimes three *stamens* or *staminodes*. *Palea* in the fourth glume perfect.

Stamens.—Three, often imperfect.

Styles.—Two, distinct, with long, shortly-plumose stigmas.

Grain.—Enclosed in the hardened glume and palea, and free from them. Spreading or creeping hard branching grasses, the flowering branches subtended by leafy or lanceolate and concave bracts.

S. hirsutus.

Stem.—Stout, creeping in the sand, forming large tufts.

Leaves.—Often above 1 foot long, with involute margins, clothed as well as the whole plant with silky or woolly hairs.

* Diœcious means having the male and female inflorescence on separate plants. This is very unusual in grasses.

Male plant: Spikes.—Sessile or pedunculate, few or many in a terminal head or umbel, and often a cluster of two or three spikes, or a single spike lower down on the stem; each spike 1 to 1½ inches long; the rachis produced into a point usually exceeding the spikelets, and sometimes very long.

Bracts.—Under the spikes or peduncles, lanceolate, acuminate, concave.

Spikelets.—Sessile in the spike or scarcely pedicellate, 5 to 6 lines long.

Glumes.—Membranous, hairy, the empty ones five or seven-nerved, usually as long as or longer than the flowering ones.

Fertile plant: Spikelets.—Very numerous, in a large dense globular head, each one solitary at the base of a spine-like rachis of 4 inches or more, subtended by a much shorter linear-lanceolate bract, the spikelet 6 to 7 lines long, acute or acuminate.

Glumes.—All nearly similar, with seven or more nerves, the two outer ones rather the largest, with more nerves than the others. A *palea* and sometimes three *stamens* in the axil of the third, and an *ovary* and three *stamens* or *staminodes* in the terminal one.

[N.B.—The female or fertile inflorescence is often gathered for ornamental purposes.]

Economic Value.—Its only use, though that is a great one, is as a sandstay. The Marram Grass (a European species) is more valuable for resisting the encroachments of rolling sand than is the grass under present notice, but we should not neglect our indigenous plants. The Marram Grass will be figured shortly, and an account of it is postponed until then; but the Spiny Rolling Grass, planted already by bountiful Nature along many parts of our coast, is capable of much good if landowners and public officers would only encourage its growth as a sandstay. Stock will not eat it, which circumstance is both an advantage and a drawback. It may be propagated readily, and it is of rapid growth. The Spiny Rolling Grass and the Marram are different in habit; the former is more prostrate, while the latter is tall and erect, like rushes.

In this connection the Newcastle sand-drift forces itself at once on our notice. At Newcastle and at other places on our coast (*e.g.*, Wollongong), the Spiny Rolling Grass has done much service, although it promises to fall into comparative neglect through the phenomenal success which has attended the introduction of the Marram Grass into Australia.

As has been pointed out in the course of an inquiry in regard to sandstays in India, no one plant is serviceable in all situations for the purpose; but where it is desired to utilise a grass, the Spiny Rolling Grass should always be given a trial. One advantage of it is its extensive geographical range, for it is practically indigenous all round the continent. Sydney people will find quantities of it at the Spit, near Manly, and at Lady Robinson's Beach.

Many other of our native plants have been used as sandstays in addition to the grasses, *e.g.*, *Acacia longifolia*, Willd., var. *Sophoræ*, a golden wattle, with very spreading habit; several of the tea-trees, and particularly *Leptospermum lævigatum*, F.v.M., together with several of the *Melaleucas*. Then some of our *Casuarinas* are most valuable, particularly *C. glauca*, the swamp oak, and *C. Cunninghamiana*, the river oak. To cite but one instance, one of the islands in the Bega River would be washed away if the oaks on it were felled, and hence they are protected by the Forest Department. An allied species (*C. equisetifolia*) is very largely planted in India in almost pure sand, particularly in the Madras Presidency.

In older countries the question of preventing the encroachment of sea-sand upon adjacent land has often become of the greatest importance. The reclamation of the "Landes" of south-western France, occurs at once to most of us. Here millions of acres of desert wastes have been transformed

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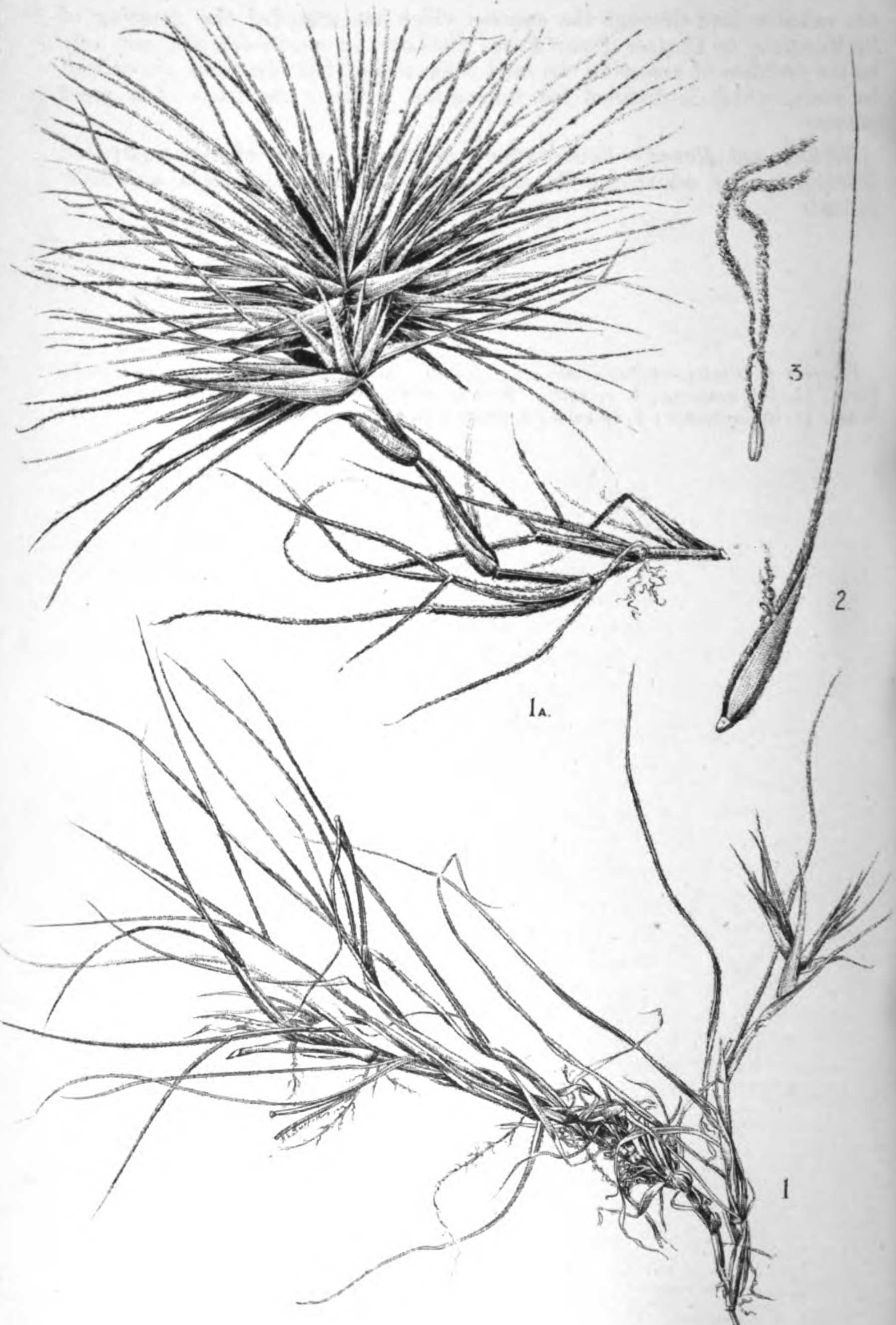
Spinifex hirsutus, Labill.

(Male Plant.)



(11 b 174-94)

Spinifex hirsutus, Labill.

(Female or Fertile Plant.)

into valuable land through the success which has attended the planting of the Maritime or Cluster Pine (*Pinus Pinaster*, or *maritima*), and not only has the problem of arresting the sand been solved, but the trees are tapped for resin, which is distilled for turpentine, forming the basis of a great industry.

Habitat and Range.—Found round nearly the whole of the Australian Colonies, on the sea-shore. It extends also to New Caledonia and New Zealand.

Reference to Plates.—Spinifex hirsutus; Labill. Male plant—1, creeping stem with foliage; 1*a*, inflorescence; 2, spikelet. Female or fertile plant—1, creeping stem with foliage; 1*a*, inflorescence; 2, spikelet; 3, ovary with feathery stigmas.

A List of Plants collected by Mr. Richard Helms in the Australian Alps, February, 1893.

By J. H. MAIDEN,
Consulting Botanist.

Mr. Helms, an officer of the Department, collected the plants named below in the neighbourhood of Mount Kosciusko, in the south-east of this Colony, on the borderland between New South Wales and Victoria. The collection includes no ferns or other Cryptogams, nor, as far as I can see, any species not hitherto recorded from this interesting locality; but publication of the list of plants will prove interesting for reference, as local floras are of great practical help to botanical workers, and the literature of Kosciusko plants is not readily available to many.

RANUNCULACEÆ.

Ranunculus Millani, F. v. M.—Pretty Point, 5,600 to 7,000 feet.
Ranunculus anemoneus, F. v. M.—6,500 to 7,000 feet.
Ranunculus Gunnianus, Hook.—7,000 feet.
Ranunculus Muelleri, Benth.—Pretty Point, 6,000 to 6,500 feet.

MAGNOLIACEÆ.

Drimys aromatica, F. v. M.—Lake Merewether, 6,000 feet.

CRUCIFERÆ.

Cardamine dictyosperma, Hook.—6,500 to 7,000 feet.

VIOLARIEÆ.

Viola betonicæfolia, Sm.—6,000 to 6,500 feet.

POLYGALEÆ.

Comesperma retusum, Labill.—Pretty Point, 5,600 feet.

CARYOPHYLLEÆ.

Stellaria pungens, Brongn.—5,000 to 6,500 feet.
Colobanthus subulatus, Hook., f. (syn. *C. Benthamianus*, Fenzl.)—6,000 to 7,000 feet.

PORTULACEÆ.

Claytonia australasica, Hook., f.—Pretty Point, 5,600 feet; also 7,000 feet.

LINEÆ.

Linum marginale, A. Cunn.—Pretty Point, 5,600 feet.

GERANIACEÆ.

Geranium dissectum, Linn. (syn. *G. pilosum*, Soland.)—5,500 to 6,500 feet.
Pelargonium australe, Willd.—6,000 feet.

RUTACEÆ.

Correa (?) sp. (foliage only).—6,000 to 6,500 feet.—Leaves broadly ovate, about $\frac{5}{8}$ inch long.

STACKHOUSIEÆ.

Stackhousia pulvinaris, F. v. M.—7,000 feet.

LEGUMINOSÆ.

Oxylobium alpestre, F. v. M.—6,500 feet.
Pultenæa fasciculata, Benth.—Pretty Point, 5,600 feet.
Bossiæa foliosa, A. Cunn.—Pretty Point, 5,600 feet.
Hovea longifolia, R. Br., var. *lanceolata*, Benth.—Pretty Point, 6,000 feet.
Acacia siculiformis, A. Cunn.—5,000 feet.

ROSACEÆ.

Rubus parvifolius, Linn.—Pretty Point, 6,000 feet.
Alchemilla vulgaris, Linn.—Lake Albina, 6,500 feet.
Acæna sanguisorbæ, Vahl.—Pretty Point, 5,600 feet.

CRASSULACEÆ.

Tillæa verticillaris, DC.—Pretty Point, 5,600 feet.

DROSERACEÆ.

Drosera arcturi, Hook.—5,000 to 6,500 feet.

MYRTACEÆ.

Bæckia Gunniana, Schau.—Pretty Point, 5,600 feet; also to 7,000 feet.—The specimens from different localities vary in size, though apparently not in the shape of the leaves.

Leptospermum lanigerum, Sm.—Jindabyne, 3,000 feet; also Pretty Point, 5,600 feet.

Kunzea peduncularis, F. v. M.—Jindabyne, 3,000 feet.

Callistemon salignus, DC.—Note by Mr. Helms:—"This species is found from 5,500 to 6,500 feet. For general localisation, instead of Mount Kosciusko, Kosciusko Plateau might be more advantageously adopted."

Callistemon salignus, DC., var. *Sieberi*, F. v. M.—Pretty Point, 5,600 feet.

Eucalyptus coriacea, A. Cunn. (syn. *E. pauciflora*, Sieb.)—6,000 to 6,500 feet.—The alpine form of this species with smaller and more rigid leaves than the normal species.

ONAGARIEÆ.

Epilobium glabellum, Forst.—Pretty Point, 5,600 feet; also 6,000 feet.

UMBELLIFERÆ.

Hydrocotyle hirta, R. Br., var. *pusilla*, Benth.—6,000 to 7,000 feet.—Agrees well with the variety figured in Hooker. *Fl. Tasm.*, xxxiii (A), as *H. vagans.*

Azorella cuneifolia, F. v. M.—6,000 feet.

Azorella dichopetala, Benth.—6,500 to 7,000 feet.

Diplaspis hydrocotylea, Hook. f. (syn. *Huanaca hydrocotylea*, Benth., et Hook. f.)—7,000 feet.

Seseli algens, F. v. M.—6,500 feet.

Aciphylla simplicifolia, F. v. M.—6,500 feet.

Aciphylla glacialis, F. v. M.—7,000 feet.

Oreomyrrhis andicola, Endl. (Two forms).—6,500 to 7,000 feet.

Oreomyrrhis pulvinifica, F. v. M.—6,000 to 7,000 feet.

RUBIACEÆ.

Nertera depressa, Banks (Syn. *Coprosma Nertera*, F. v. M.)—6,500 feet.

Asperula conferta, Hook. f.—6,000 feet.

Asperula Gunnii, Hook. f.—6,000 to 6,500 feet.—(These two species are included by Baron von Mueller under *A. oligantha*, F. v. M.)

COMPOSITÆ.

Olearia megalophylla, F. v. M. (syn. *Aster megalophylla*, F. v. M.)—5,000 to 6,000 feet.—The flower-heads are not clustered, and are on elongated petioles, which give the plant a different appearance from the type.

Olearia stellulata, DC. (Syn. *Aster stellulatus*, Labill.)—5,000 to 6,500 feet.—This form is nearest to var. *canescens*, Benth.

Olearia iodochroa, F. v. M. (Syn. *Aster iodochrus*, F. v. M.)—5,000 to 6,500 feet.

Celmisia longifolia, Cass. (Syn. *Aster Celmisia*, F. v. M.)—Pretty Point, 5,600 feet; also 6,000 to 7,000 feet. Including a very slender form.

Brachycome radicans, Steetz.—6,500 feet.

Brachycome scapigera, DC.—6,000 to 6,500 feet. In the *Flora Australiensis*, "flower heads not large."—In these specimens the flower heads are rather large.

Brachycome nivalis, F. v. M.—6,000 to 7,000 feet.

Brachycome stricta, DC.—6,500 feet.

Craspedia Richea, Cass.—6,500 to 7,000 feet.

Craspedia Richea, Cass., var., *alpina*, Benth.—7,000 feet.

Cassinia aculeata, R. Br.—Jindabyne 3,000 feet, also up to 5,500 feet.

Podolepis longipedata, A Cunn.—5,000 feet.

Podolepis acuminata, R. Br.—5,500 to 7,000 feet.

Leptorrhynchos squamatus, Less. (Syn. *L. nitidulus*, DC.)—6,000 feet.

Helichrysum bracteatum, Willd. (Syn. *H. lucidum*, Henckel).—5,000 to 6,000 feet.—This plant has a little cottony wool which may help to connect it with *H. Milligani*, Hook. f.

Helichrysum rosmarinifolium, Less., var. (*a*).—Pretty Point, 5,500 feet. I cannot distinguish this form from *Ozothamnus thyrsoideus*, DC., described in Hook. f. *Fl. Tasm.*, i, 205.

Helichrysum rosmarinifolium, Less., var. (β).—6,000 to 7,000 feet. This form is apparently identical with *Ozothamnus ericæfolius*, Hook. f. figured at t. 57 of Hook. f. *Fl. Tasm.*

Helipterum anthemoides, DC.—5,000 to 6,500 feet.

Helipterum incanum, DC.—6,000 to 7,000 feet.—The yellow-flowered variety was collected at the lower, and the white-flowered at the higher elevation.

Raoulia Catipes, Hook f. (Syn. *Leontopodium Catipes*, F. v. M.)—7,000 feet.

Gnaphalium japonicum, Thunb. (Alpine form).—7,000 feet.—About an inch high, and forming a dense matted growth.

Senecio pectinatus, DC., var., *pleiocepalus*, Benth.—Pretty Point, 5,600 feet.

Senecio Georgianus, DC.—Pretty Point, 5,600 feet.

Microseris Forsteri, Hook. f.—5,000 feet.

STYLIDIEÆ.

Stylidium graminifolium, Swartz. (Syn. *Candollea serrulata*, Labill.)—5,000 to 6,500 feet.

GOODENIACEÆ.

Goodenia hederacea, Sm.—Snowy Mountains, 6,000 to 7,000 feet.

Scævola Hookeri, F. v. M.—6,500 to 7,000 feet.

CAMPANULACEÆ.

Wahlenbergia gracilis, A. DC.—Pretty Point, 5,600 feet.

EPACRIDEÆ.

Pentachondra pumila, R. Br. (Syn. *Trochocarpa pumila*, F. v. M.)—6,000 to 7,000 feet.

Monotoca elliptica, R. Br.—6,000 to 6,500 feet.

Epacris petrophila, Hook. f.—5,500 to 6,500 feet.

Richea Gunnii, Hook. f.—5,500 to 6,500 feet.

GENTIANEÆ.

Gentiana montana, Forst., var. *saxosa*, Benth. (Syn. *G. saxosa*, Forst.)—5,000 to 7,000 feet.

SCROPHULARINEÆ.

Veronica Derwentia, Andr.—5,000 to 6,500 feet.

Veronica nivea, Lindl.—Tate Range, 6,000 feet.

Euphrasia collina, R. Br. (Syn. *E. Brownii*, F. v. M.)—Pretty Point, 5,600 to 6,000 feet; also up to 7,000 feet.

Euphrasia antarctica, Benth.—Mount Townsend, 7,000 feet.

LABIATÆ.

Prostanthera cuneata, Benth.—5,500 to 6,500 feet.

PLANTAGINEÆ.

Plantago varia, R. Br.—6,000 feet.

Plantago stellaris, F. v. M.—6,500 to 7,000 feet.

Plantago Gunnii, Hook. f.—6,500 to 7,000 feet.

PARONYCHIACEÆ.

Scleranthus biflorus, Hook. f.—Pretty Point, 5,600 feet.

POLYGONACEÆ.

Rumex Brownii, Campd.—Pretty Point, 6,000 feet.

PROTEACEÆ.

Orites lancifolia, F. v. M.—6,500 feet.

Grevillea (?) *australis*, R. Br. (Foliage only.)—6,500 feet.

Lomatia longifolia, R. Br., var. Jindabyne, 3,000 feet.—This form has the usual linear-lanceolate leaves, but none of them exceed 2 inches in length.

THYMELÆACEÆ.

Pimelea alpina, F. v. M.—6,500 to 7,000 feet.

Pimelea hypericina, Benth., var. *ligustrina*, Labill.—Pretty Point, 6,000 feet.

EUPHORBIACEÆ.

Poranthera microphylla, Brongn.—6,500 feet.

ORCHIDEÆ.

Prasophyllum patens, R. Br.—6,000 to 6,500 feet.

LILIACEÆ.

Astelia alpina, R. Br.—6,000 to 7,000 feet.

Dianella tasmanica, Hook. f.—Pretty Point, 5,600 feet.

Bulbine bulbosa, Haw.—5,000 feet.

Arthropodium paniculatum, R. Br.—5,000 feet.

JUNCEÆ.

Luzula campestris, DC.—Pretty Point, 5,500 feet.

Juncus falcatus, E. Mey.—Pretty Point, 5,500 feet.

RESTIACEÆ.

Restio australis, R. Br.—Pretty Point, 5,500 feet.

CYPERACEÆ.

Scirpus crassiusculus, Hook. f. (Syn. *Isolepis crassiusculus*, Hook. f.—Pretty Point, 5,500 feet.

Carpha alpina, R. Br.—Pretty Point, 5,500 feet.

Carex (?) *declinata*, Boott.—Pretty Point, 5,500 feet. The spikelets appear to be all empty.

Carex vulgaris, Fries., var. *Gaudichaudiana*, Boott. (Syn. *C. cæspitosa*, R. Br.)—Pretty Point, 5,500 feet.

GRAMINEÆ.

Agrostis scabra, Willd.—Pretty Point, 5,500 feet.

Agrostis venusta, Trin.—Pretty Point, 5,500 feet.

Deschampsia cæspitosa, Beauv. (Syn. *Aira cæspitosa*, Linn.)—5,000 to 6,000 feet.

Trisetum subspicatum, Beauv.—6,000 feet.

Danthonia penicillata, F. v. M. (3 forms.)—4,500 feet.

Danthonia robusta, F. v. M.—6,000 to 7,000 feet.

Poa cæspitosa, Forst., var. *latifolia*, Benth.—6,000 feet.

Schedonorus Hookerianus, Benth. (Syn. *Poa Hookeriana*, F. v. M.)—Pretty Point, 5,500 feet.

Agropyrum pectinatum, Beauv.—5,000 to 6,000 feet.

Botanical Notes.

Durability of Colonial Timbers.

Mr. Forester Brown, of Port Macquarie, has recently sent to the Department some interesting specimens, which show the durability of some of our Colonial timbers under rather adverse circumstances. The White Beech is *Gmelina Leichhardtii;* the Ironbark is red, and probably *Eucalyptus siderophloia;* the Blackbutt is *Eucalyptus pilularis*; and the Grey Gum is *Eucalyptus saligna* var. (*see* last month's *Gazette*, p. 746).

Specimens of old timber from a windmill at Port Macquarie, erected in 1832. This windmill has not been worked for about thirty years, ten years of which time the inside has been exposed to the weather:—

White Beech—

(1) Section of brace to support roof, 9 in. x 4½ in.; perfectly sound.

(2) Section of cog of large wheel; thirty-two years in use; perfectly sound.

Ironbark—

Section of sail-arm, 5 ft. x 5 ft.; very superficial weathering; otherwise perfectly sound.

Blackbutt—

Section of brake to stop machinery, 8 in. x 8 in.; fissures have opened, and dry rot has set in through exposure to damp.

Specimens of old timber from the Old Asylum, Port Macquarie. This building was erected about 1840, and pulled down in 1893:—

White Beech—

(1) Section of flooring-board fifty-three years in use, 6 in. x 1 in.; quite sound, and has kept its colour well.

(2) Section of window-frame, fifty-three years in use, 5½ in. x 4 in.; perished at one angle of the frame where it has been in contact with the ground; otherwise sound.

Grey Gum—

Section of plate fifty-three years in use, 4 ft. x 2 ft.; perfectly sound.

Blackbutt—

Section of plate fifty-three years in use, 3½ ft. x 2½ in.; cracked somewhat outside, but otherwise sound.

Grass-tree Gum.

The following notes by Foresters G. R. Brown, of Port Macquarie, and Augustus Rudder, of Booral, supplement the information given in last month's *Gazette*, page 748. Both these Foresters chiefly refer to *Xanthorrhœa aborea* and its red resin.

Mr. Forester G. R. Brown, of Port Macquarie, states:—" The Grass-tree is scattered throughout this district, and grows to an average height of from 8 to 10 feet. It favours sandy and stony soils. The base of the inner leaves,

which has a pleasant juicy taste, was eaten by the Aboriginals. As a rule, the resin from the plant is found after bush-fires about the roots, near to the butt. The resin is often used by the Chinese for varnishing cheap furniture made by them in Sydney. The tree is also split in half, and after the centre pith is cleaned out, used, principally on the Diggings, for spouts to carry water a distance; for this purpose it is much more suitable than the Bangalow Palm."

Mr. Rudder states:—"The grass-tree is present in this district, but not in very great quantity. It is met with within a few miles from here (Booral), and near Bulladelah, and on the Wallingat, but more plentifully on the tops of some of the mountains near Copeland. I have observed it, more or less, in all the districts between Booral and Queensland, and in almost all sorts of soil and situations, both on the banks of tidal streams and on the tops of the highest mountains. In the Hastings district, particularly in the neighbourhood of Mount Seaview, it was very plentiful, and may be so at present. There it grew on the slopes of the hills to their summits. With regard to soil, I have seen it thriving on barren clayey land, on sandy land, on rich alluvial, on the banks of streams and gullies and skirts of brushes, on the tops of scrubby mountains, and on open forests of porphyritic and slate formations; but, as far as I have observed, it seems to prefer the basalt country. On the richer alluvial soil in particular—I think it depends a good deal on the nature of the *débris* forming it—it grows luxuriously, and branches out a good deal, though in such situations it is, I think, less productive of gum than is the case with trees growing on poorer soils and more exposed situations. This gum, or resin, is found lodged between the laminæ formed by the flattened base of the long thin angular leaves, but in much larger quantity in the rind or bark of these plants, of which, in fairly good specimens, it probably constitutes fully a third part of the whole; but none of it seems to exist in their pithy fibrous centres. In many cases the resin is found to exude from the plants where wounded, also under the influence of bush-fires, and is often found at their base, above the roots, or a little under the surface of the ground, in an almost pure state. The grass-tree, when not in flower, attains an elevation of about 10 to 15 feet, with a diameter of about 9 or 10 inches, and in the blooming-time throws up a spike from 6 to 10 feet in length, which is covered with small, white star-shaped sessile bloom, very attractive to bees. The tree is of gregarious habit. With regard to my rough estimate of the percentage of resin in the bark of this plant, it is intended as an all-round average of those of all ages and sizes. In the case, however, of young trees with lobes, say of about 4 to 6 feet in elevation—where they have not suffered much from bush-fires—their bark is thicker, and its yield in resin, I should think, fully 50 or 60 per cent., and of far superior quality to that in the old trees, which, as a rule, have been scorched many times by bush-fires, and so damaged. In the olden days the Aborigines used this resin, mixed with the wax of the native bees, in the fastenings of their weapons, &c. I have also seen it used by boiling and mixing with coal-tar for dressing under the lining of old boots; but in the boiling great care is needed, owing to its great tendency to froth over. The base of the young tender leaves of this plant are palatable, and, as far as I have tried them, wholesome, and would, no doubt, help to sustain the life of a person lost in the bush. I should have stated that there are several other varieties of Xanthorrhæa besides that mentioned in this Report, but most of them are of a dwarf character, and are usually found growing on very poor clayey or sandy soils; these, as far as I am aware, are of no value."

The Clustered Clover (*Trifolium glomeratum*, Linn.)

This is a very old introduction to New South Wales, having probably been brought with White Clover seed in the first place. Within a week it has been sent to the Department by four different correspondents—at Deniliquin, Condobolin, Mowabla, and Inverell—the writers stating that they notice it for the first time, so the probability is that it is spreading. It will be remembered that the Barnyard Grass (*Panicum Crus-galli*) spread similarly last year. This Trefoil, or Clover, is a native of England and the continent of Europe, but it has no reputation as a fodder-plant, being rather a small and somewhat harsh plant in its native countries. But in New South Wales it appears to attain a more luxuriant growth, for specimens that have passed through my hands are larger, and apparently more succulent, than European-grown specimens in my possession. A correspondent of the Department from Mowabla writes:—"It is greedily eaten by stock; is evidently much preferred to the common Trefoil, and grows very abundantly. . . . My opinion is that it will become a most valuable fodder-plant in this part of the Central Division." There is room for inquiry in regard to this plant, and therefore I should be glad if pastoralists and others would favour the Department with their experience. In the coast districts I have noticed it apparently endeavouring to elbow out White Clover, and while stock crop it readily enough with other herbage, I do not think that we have much evidence yet, of a specific character, in regard to it. It is common enough in the coast and mountain districts of the Colony, and will be found to dry up at the approach of hot weather. It bears some resemblance to white clover in general appearance.

Weeds.

By C. T. MUSSON,
Hawkesbury Agricultural College.

Definition of "Weeds."

"WEEDS" are defined as, "Plants out of place"; "Any plant growing in cultivated ground to the injury of the crop or desired vegetation, or to the disfigurement of the place"; "Any unsightly, useless, or injurious plant." Webster adds, "the word has no definite application to any particular plant."

Without entering into any critical examination as to exactly what plants *are* weeds and what are not, we may accept as "weeds" any plants that are of no use to man, so far as we know, and are impediments to cultivation. In a general way this definition of "weeds" will serve our present purpose. It will be shown shortly that plants may be at one time weeds, whilst under different circumstances they may be fairly classed as useful; moreover, it may be said that, contemplating plants as a great assemblage of life forms, none of them are without some use in the world. It is from man's special point of view as a cultivator that weeds incur odium, for there can be no doubt that even weeds fulfil a duty in the great scheme of nature.

Plants become "weeds," not because of any innate tendency on the part of plants causing them to pose as ill-conditioned members of the vegetable kingdom, but on the consent and by the inaction of man. They become "weeds" when they crowd out other more useful plants.

Shakespeare says, "Most subject is the fattest soil to weeds." Good soil grows weeds better than does poor; the obvious lesson to be gathered from this fact is, "not to let the useless plants grow"; man can by forethought and by the adoption of proper precautions keep such down and allow only useful plants to mature.

Disadvantages of Weeds.

It will be interesting to observe in what ways weeds are disadvantageous.

(*a*) When growing luxuriantly they prevent sunlight from acting properly on the ground or on any low growing crop, consequently diminishing soil activity and assimilative power in the crop.

(*b*) They prevent air from reaching the soil; this is bad again, for the supply of oxygen then runs short. They also absorb much moisture.

(*c*) They take plant food out of the soil that might be reserved there, or, better still, be made use of by some useful crop. We must remember, however, that when weeds are ploughed in, especially such as are Leguminosæ, they make good green manure. The cultivator could and should avail him-

self of the fact, and sow suitable seed where found necessary, with the express intention of growing a crop to be used as a green manure; weeds would, under such circumstances, be to a great extent smothered out, and the maximum capabilities of the soil made use of. We should be taxing the soil too much, however, if such crops are always *reaped*; when grown between fruit trees, and in many other cases, they should be grown as "plant food conservers," and ploughed in as indicated.

(*d*) They cause great loss of time in the work necessary for their eradication; though, we must remember, this necessitates constant cultivation, and in frequently stirring the soil we encourage favourable circumstances with respect to plant growth.

(*e*) Many weeds are detrimental to stock, being distinctly injurious, either (1) from being poisonous, or reputed so, as Darling Pea and other Leguminosæ, certain Euphorbiaceæ, Thymelaceæ, and Campanulaceæ. No doubt many cases of plants proving unwholesome for stock arise from the fact that, owing to regular food being scarce, they change to a new kind suddenly, and are at times seriously affected thereby, the result causing apparent poisoning; or (2) they may be indirectly injurious, not from any poisonous qualities inherent in the plant, but from the fact that a heavy feed on such plants as the stagger-weed, causes formation of gas in the animal's stomach and brings about the condition known as "blown" or "hoven"; or (3) plants may be injurious to wool, as spear grasses, clover burr, and Bathurst burr; or (4) injury may be done to the stock through mechanical causes, as in the case of spear grasses injuring sheep, emex, and the fruits of Paddy lucerne causing inflammation in fowls.

(*f*) Some are parasitic, as dodder and mistletoe, true plant thieves.

(*g*) Fungous pests live upon weeds parasitically, to the detriment of the weeds certainly, but such plants in supporting fungi help to retain in existence innumerable colonies of fungoid pests. To take one case out of many: numerous wild Cruciferæ are the hosts of white-rust and a powdery mildew (a Peronospora, very common on a wild Senebiera with us), both of which pests attack crop plants of the same natural order, as cabbage and horse-radish, at times causing serious damage.

Were there no weeds, we, in treating plants for diseases, would have our chances of eradicating them enormously increased. Many spores would die out without germinating if no nurse-plant existed to be made use of, perhaps, just at a critical time, when, failing a nurse-plant, the spores must die.

Failing crop plants, weeds form the hosts upon which many fungi live. We treat the crop plants and allow the weeds to carry on their pernicious work. Theoretically, we should allow nothing to grow in our cultivated ground unless acting beneficially; practically, this is almost impossible, our every-day life shows that we cannot always do what we should do. Did we follow this rule out, however, to the best of our ability, we should certainly reduce many pests to a minimum, bringing plant disease under such control as would enable such as occurred to be much more satisfactorily dealt with than is at present the case.

All fungus-smitten plants may be looked upon as detrimental in one way or another, directly or indirectly; they *must* be detrimental to stock, as has been pointed out by several writers, though we may frequently not be able to trace the ill effects. A few amongst the parasitic fungi are useful, amongst them Ergot of Rye: this pest, though medicinally valuable, has a disastrous effect upon cattle if eaten by them. The Root-tubercle Bacilli of Leguminosæ furnish another instance.

(*h*) Not only do weeds support fungous pests, which at times attack our crops, but they, to a large extent, provide food for insects, which, in very many cases, when opportunities arise, attack crop plants. For instance, many of subterranean habit, wireworms (the larvæ of click beetles), curly white grubs (larvæ of cockchafers), mole crickets, and others, attack plant roots indiscriminately. Again, wild Solanums support insects that will damage cultivated plants; the 28-spot ladybird in this country and the Colorado beetle in U.S.A. for instance. In cultivated ground the soil is kept loose, and as crop plants are often very succulent, and even weeds grow more luxuriantly in such soil than in such as is hard and uncultivated, plentiful food, and of the most approved kind, is provided for insects. It is easy, therefore, to understand why pests concentrate in the cultivated parts of the earth. We must not forget that in doing away with much of the earth's natural covering of grass and forest we are destroying insect food. Insects must find food somewhere or die; consequently our crops suffer. Moreover, it is only natural that our tender succulent vegetables and fruits should be appreciated when once tried. Damage consequent upon insect attack prepares the way and provides opportunities for fungoid pests which are present everywhere in the spore state, generally incapable of damaging a plant whose protective epidermis is intact, but ready for any chance bruise or open spot of any kind on the bark of the stem or the skin of the fruit that will give access to the soft tissues: if an opening is found the plant has to suffer from fungous attack, and is to a great extent powerless to resist. The spore simply fulfils its life's work, building up a new generation, making use for that purpose of food provided by the host.

From the insect and fungus point of view, the allowing of weeds to grow is just the particular thing required at times to tide them over periods of drought, danger, and distress. In keeping weeds down we either kill pests out by starving them or we drive them away in search of food. In the latter case our neighbours should see that they have not allowed their weeds to remain to provoke attack by presenting the travelling pests with attractive food. In all cases (very numerous in nature) where insects and fungi can only flourish on some one plant or small group of plants, we prevent the pests from establishing themselves if we keep down their natural food plants, as they do not readily take to new kinds of food. Many pests have, however, through stress of circumstances, become accustomed to variety of food; more particularly is this the case with locusts, scale, and many insects that feed by means of a sucking tube.

Weeds sometimes advantageous.

There is, however, another side to the question. "Weeds" are not always useless, either in themselves or by nature of their location. Many plants that are weeds under one set of circumstances, may become useful plants under another. This apparent paradox introduces one of the most interesting phases of the whole subject. A few examples will serve to illustrate the point.

1. On steep ground where heavy rainfall occurs it is sometimes advisable to allow orchard weeds to remain through the worst of the rainy weather, as they prevent the soil from being washed away. Under such circumstances plants that are suitable for green manure would grow equally as well as weeds and prove more useful—Buckwheat or some suitable leguminose plant, for instance, providing at once protection for the soil, plentiful bee food, and, when ploughed in, good green manure. Such a crop would conserve impor-

tant manurial elements that might otherwise be carried away in the rain-water draining from the land, besides returning to the soil, in the case of leguminosæ, more nitrogen than it took out; the supply of this important element coming partly from the air through the medium of special organisms in the root tubercles.

2. Weeds sometimes provide good food for stock. The clover burr (*Medicago denticulata*), although damaging wool by reason of its hooked fruits, being difficult to clear away when once in it, is a most useful fodder plant, both in respect of its stem and leaves, and of the fruits when ripe; when nothing of stem or leaf remains, the fruits, often lying on the ground in great numbers, not only keep alive, but will fatten sheep. The Cape weed (*Cryptostemma calendulacea*), an introduced composite, is also useful as a fodder plant; and an introduced Crowfoot, one of the Geraniaceæ, gives, in the Riverina, a most valuable spring fodder. I have seen horses daintily picking the flowers from heads of the despised black thistle. The variegated or spotted thistle (*Carduus marianus*) makes capital ensilage, indeed, it is said that *all* weeds are suitable for the silo. Balm or Stagger weed (*Stachys arvensis*) is most plentiful in orchards with us; it is a valuable bee plant, a quality also possessed by the small Cape weed or mock dandelion (*Hypochæris*). Paddy lucerne (*Sida rhombifolia*), a bad weed when growing out of place and uncared for, sown thickly and properly looked after, produces a useful fibre, not of the first class, but quite as good as many fibres that find a market; moreover, the leaves and young tops are freely eaten by stock. The nut grass (*Cyperus rotundus*), an ineradicable pest in cultivated ground, finds a use for its tubers in their being good pig food (the ground, however, is so rooted up in the search for them, that its appearance is quite spoilt), and when dry and crushed they are sweet-scented. Horehound (*Marrubium vulgare*), a common weed in many parts of New South Wales, when dried is marketable in moderate quantities. Couch grass (*Cynodon dactylon*), a bad weed of cultivation, but a valuable fodder grass, finds another use in India, where the underground stems are turned to account in making a cooling summer drink. All our cultivated plants have descended from wild forms possessing some favourable characteristic; by careful cultivation and selection their possibilities in certain directions have been encouraged and developed; take away the care and attention and they revert to their original forms. Many plants, frequently called weeds, form valuable additions to our pastures, from possessing medicinal properties, tonic or purgative, for instance, not only giving varied, but healthy, food. It is a question whether we are right in applying the word "useless" to any plant; even in the case of any so-called poisonous plants there is something to be said: it would be an interesting point to decide whether poisonous principles in plants (of which, by the way, nothing can be traced in our well-known Darling pea), frequently dissipated by heat, would be got rid of in the silo.

Where our Weeds came from.

Many of our so-called weeds are native to the country, but a large proportion of the worst of them have been introduced from abroad. About 250 species of foreign plants are now found naturalized in New South Wales, coming from all parts of the world, but chiefly from those countries with which our commercial intercourse is greatest. Some of them were introduced as useful plants of set purpose, but having fallen into disuse now cumber the ground; the greater quantity, no doubt, have been brought unwittingly by man in the ordinary course of trade. Only a short time ago

a box of fig cuttings from Smyrna was opened in the College orchard; next season several strange plants sprang up near where the unpacking had been done. Amongst them* *Artemisia vulgaris*, a composite; *Hypecoum procumbens*, a poppy; *A. vesicaria*, allied to the starworts and pinks; *Trifolium resupinatum*, and two other undetermined *Leguminoseæ*. We were very careful to destroy every example of these plants before seeding. I lately received through a student of the College specimens of what is evidently *Martynia proboscidea*, one of the *Pedaliaceæ*, from a paddock in the Richmond Bottoms. In the course of trade exchanges, various seeds travel from country to country. "Over sixty species of aliens have appeared on railway banks, on dredgings from the river Trent, and on waste ground near malt-kilns and mills at Newark (England) recently—that is, since the barley, wheat, oats, and linseed have been imported from Smyrna, Cyprus, Bohemia, Hungary, and other foreign lands."† Amongst the plants mentioned in the list are several that we recognise as bad weeds here, *e.g.*, the star thistles.

How Weeds become distributed.

It is of great interest to note that plants very frequently possess special structures that aid in the distribution of their seeds; especially is this the case with many of our more pernicious weeds, indeed it is often the case that the very peculiarity causing a plant to be a dreaded weed is the particular means by which the plant is enabled to distribute its seeds. In the Bathurst burr there are strong hooks on the fruit that secure it firmly, as we know, to the tails of animals and to the wool of sheep; we look upon the plant as a curse, and so it is from our point of view, but could the plant speak for itself it would thank us heartily for keeping sheep and for travelling them, as owing to these two facts the plant is enabled to make use of its special facility for distribution. Many other plants possess in the structure of their fruits some special means enabling them to spread when aided by animals. The clover burr spreads by the same means as the Bathurst burr. Sweetbriar spreads, however, in a somewhat different way; its seeds pass through the bodies of animals without losing their germinating power. We have only to point to the condition of travelling stock routes and reserves to emphasise the point as to the help given by travelling stock in the spreading of plants abroad. Again, in the dandelions and thistles there is an aid to distribution in the hairy pappus, a sort of wind-sail which enables the fruit to which it is attached to travel great distances by help of the wind. I have seen numbers of these "flying fruits" come into a railway carriage travelling 30 miles an hour. Such travelling fruits or seeds do not always find a suitable habitat; they are, however, much helped in this country by the fact that the surface is frequently bare of grass in very dry years, or bare patches of ground occur round trees used by cattle for rubbing purposes, or along travelling stock routes. Under such circumstances all seeds have an equal chance, and the hardy intruders often dominate over the native-born (indigenous). Thistles and Bathurst burr often start centres of infection in this way and gradually spread around. Some weeds are most plentiful in cultivated ground, as sour sorrel; others on grass land, as sweetbriar and thistles. Many spread from gardens where they may have been cultivated for certain reasons. Some have been introduced for fodder purposes, and

* I am indebted to Mr. F. Turner, F.L.S., for the names.

† On the Botany of Nottinghamshire, by H. Fisher, in "A Contribution to the Geology and Natural History of Nottinghamshire," for the Nottingham Meeting of the British Association, 1893.

falling into disuse, have spread over both cultivated and uncultivated ground. Weeds may come mixed with seed, in hay, in manure, carried by birds, by the elements, by rivers, in endless varieties of ways; most interesting as it would be to dilate on these points space forbids. For variety and numbers an old town not too far from the coast will, especially along its less used streets, prove most prolific in weeds, growing everywhere, even in the forks of old cedar trees and the heads of palms. It is amongst weeds and wild plants generally that the true student of nature, as reflected in plants, obtains many of his most interesting problems. Cultivated plants change their characters, therefore to get the real original type we have to look to Dame Nature herself. One only needs to read that beautiful story, "Picciola, the Prison Flower," to realise what the presence of one humble plant may be to an active mind completely shut off from communication with man and nature.

Look at "weeds" as we may, however, we must perforce conclude that such plants as are occupying ground to the detriment of crop-plants are in the way, and are useless to us for the time being; such plants it is necessary to exterminate.

How to Exterminate Weeds.

In cases of plants seen immediately on their introduction, this is a tolerably easy matter; they should not be allowed to establish a foothold. We have heard of the person who saw the first few plants of Bathurst burr. Five minutes exertion to uproot them, a fire to destroy them, and years of troublesome work, millions of money, would have been saved; but "it is as it is"; we have the burrs, probably now never to get rid of them. In eradicating first centres of infection we prevent pests spreading; any suspicious-looking newcomers should therefore invariably be carefully destroyed. It is frequently not sufficient to merely pull them up, especially if the fruit is ripe.

In endeavouring to exterminate weeds generally the nature of the plant must be taken into consideration. Annuals should be prevented from seeding. Biennials and perennials, all such as propagate by means of their roots, tubers, underground stems, and such means, should be prevented from breathing, by keeping the leaves from appearing. Early and constant cultivation will therefore keep them down in cultivated ground. Shakespeare says—

> "'tis spring, and weeds are shallow-rooted,
> Suffer them now, and they'll o'errun the garden."

In preventing plants from maturing their seed we prevent them from spreading; and in constantly chipping out biennials and perennials we prevent the plant developing its stores of nourishment in tubers, stems, and other parts. Apart also from the beneficial effect secured in several ways by keeping weeds down, the crops benefit directly, particularly in dry regions, through constant stirring of the soil.* In case of weeds on garden paths, boiling water, or some weed exterminator, may be used with advantage. Selvidges to cultivated ground are commonly left to look after themselves. These narrow strips are usually prolific in weeds, and act as reserves from which such plants are distributed in all directions. If it is impossible to

*"The moisture saved by arresting surface evaporation must not be lost by allowing thirsty weeds or grass to exhaust it. It has been shown by Professor S. W. Johnson that, under similar circumstances, during a month of summer weather, the loss of water from a soil covered with growing grass was nearly two and one-half times greater than the loss from naked soil; also, that evaporation from a hoed surface was only four-fifths that from a hard surface."—(Flint.) Mr. H. C. Russell, F.R.S., has also shown "that grass brings the subsoil water to the surface and aids evaporation in dry earth."

keep such strips clean, clover or some other useful bee plant might be sown, it would soon smother out the weeds. We must, however, give if we take, we cannot expect receipts without expenditure; notwithstanding constant attention plants will be introduced from outside, and will grow where they are not wanted, meaning just this: weeds are a power in the world, so strong that they, through their omnipresence, are one great operating cause in forcing man to work. If the soil has to support weeds *and* crop the latter must suffer; given a minimum of weeds, the crop has the better opportunities; therefore we cultivate, and the more we do so the better the returns. It really rests with ourselves whether weeds trouble us or not; to keep them down means work, work means time, and time is money. On the other hand, presence of weeds means reduced return, in the crops being lighter; the expense incurred in getting rid of weeds—that is, the cost of cultivation—may be considerable, but work is provided, and we have the outlay returned to us in the increased crop.

We have, therefore, two good reasons why attention should be paid to the keeping down of weeds. In the first place better opportunities are given to the crops, in that they would be without competitors which at present cause them to be heavily handicapped in their life struggle; and in the second place constant cultivation is distinctly beneficial in its general effect upon the soil in its relation to plant-life.

It seems to me that in the growth of weeds nature asserts herself and tells us incontrovertibly "The soil cannot remain bare; it must grow something; if you, men, desire to live comfortably, you must cause the soil to grow plants useful to you, instead of such as are of no use and cause expenditure in nature in the wrong direction."

A few words in conclusion with regard to legislation on this matter. Some few noxious plants have been dealt with in order to bring about their extirpation; but success has been conspicuous by its absence. It seems to me that in order to cope with bad plant-pests, provision should be made in a comprehensive Bill, dealing with fungus, insect, and weed pests; the provisions to be carried out by qualified officers, equipped with the necessary appliances. Better, however, than any Bills would be an understanding amongst all men that noxious pests are to be exterminated. If, acting for ourselves, and up to our opinions, we all did our duty in this way, our efforts would be crowned with a great measure of success; but how many men do we know who, whilst crying out for legislation, will not take the trouble to cut down a few noxious weeds in his own paddocks, or those on the wayside near his own land?

Wagga Wagga Experimental Orchard.

By ALBERT H. BENSON,
Fruit Expert.

The Department of Agriculture having decided to establish an Experimental Orchard and Vineyard in connection with the Government Experimental Farm at Wagga Wagga, the writer and Mr. George Valder (who previously was in charge of the seed distribution, and who is now in charge of the orchard and vineyard at Wagga Wagga) were entrusted with the carrying out of the work, and proceeded to Wagga Wagga early in June last.

The following short description of the orchard and vineyard, and of the work that has already been done and that it is intended to do, as well as the objects for which it has been started, will, I feel sure, be of interest to our fruit-growers:—

The land set aside for the orchard and vineyard amounts altogether to some 73 acres, but of this 34 acres is planted to grain, and the balance of 39 acres, which is all enclosed with rabbit-proof fencing, is orchard and vineyard proper, and is now partially set out.

The land is situated on the eastern slope of a granitic outcrop, which forms a ridge, and the more easterly of the Sisters' Hills, the ridge and hill forming a good shelter from westerly winds. The soil of the upper portion of the land is a gritty granitic loam of dark colour, and about 1 foot in depth, with a reddish or yellowish gritty subsoil, containing a large percentage of clay, but not impervious. Both the soil and subsoil, when dry, are exceedingly hard and unworkable, but when worked at the proper time break down into a fine and easily worked loam, which, when thoroughly cultivated, retains moisture fairly well. The soil has a further disadvantage of caking badly after rain, so that constant and thorough cultivation is an absolute necessity for successful fruit-culture.

The further you get from the granitic outcrop the heavier the soil becomes, the colour changing gradually from the dark loams to a reddish or chocolate clay loam, which is hard to work, but which, when kept thoroughly cultivated, will grow good grapes, plums, pears, figs, apricots, &c. This red soil is the typical soil of the district, and may be considered fairly characteristic of the wheat soils of the south-western parts of the Colony. The darker granitic soil is, however, not by any means of such common occurrence, though there are many similar soils in various parts of the Colony; it is better suited for cherries, peaches, and apples than the heavier soil, and grapes would also do very well. The orchard is situated nearly due west of Bomen Railway Station, from which it is distant about 2½ miles, and, as previously noted,

lies with a slope to the east, which, taken in conjunction with the higher land lying at the back, forms a good natural protection from westerly winds, which are the hot winds of the district, and the ones to be specially guarded against.

Previous to our commencing work in June last the land had all been cleared and ploughed to a depth of 12 inches, part of the ground having been cross-ploughed. Nothing had been done to the ground after ploughing, but it was allowed to lie in as rough a state as possible, so that when we started work it was in a very uneven condition, and covered with a dense mass of weeds, that it was found impossible either to burn off or plough under, and the only way to get rid of which was to chop out and cart off the land, the constant rains and unfavourable weather keeping the work very much back. After the weeds were got off the ground was ploughed about 8 inches deep, a single-furrow two-horse "John Deere" plough being used After ploughing, the ground was harrowed and then laid out, the trees being planted in squares of 25 feet apart each way in one portion of the orchard, and at 20 feet apart each way in the other, and the vines in rectangles, containing 150 vines, set out on the square, the vines being 10 feet apart each way, with a 20-foot avenue between each rectangle. The vines are all staked, split white-pine stakes (Frenella robusta), 6 feet 6 inches long, being used. The stakes are 1 foot 6 inches in the ground and 5 feet out, and were all put in before a vine was planted, as this is a better, stronger, and more lasting job than pointing the stakes and driving them in when the vines require staking. The stakes are all placed on the upper or western side of the vines, so as to give the greatest support, and they are well laid out, the lines being true in every direction. No rooted vines were planted, cuttings only being used, and these were obtained from vignerons in different parts of New South Wales and from South Australia. Nearly 100 varieties of vines have been set out, ten vines of each variety being planted for reference purposes, and, in addition, the following grapes have been planted for drying, viz., one acre Sultanas, one acre Muscatello Gordo Blanco, one half-acre Muscat of Alexandria, one half-acre Bowood Muscat, one half-acre Zante, and one half-acre Black Corinth. All these drying grapes were obtained from Thos. Hardy and Sons, of South Australia, the pioneer raisin growers of Australia.

The northern portion of the orchard is set out in squares of 25 feet, and when fully planted will contain about 1,400 trees, consisting of the following fruits:—Apples, peaches, nectarines, oriental plums (Japanese), apricots, figs, olives, cherries, almonds, of which fruits one tree of each of the best standard varieties of each kind of fruit will be planted—first, in order to test their suitability to the district, and secondly, as a standard collection for reference purposes. Every tree will be carefully tested, and when its correctness has been proved scions will be available for distribution amongst our fruit-growers. Every possible care has been taken to obtain varieties true to name, and the greatest care is taken to keep them true—every graft having been put on by myself, and the most careful record kept. A large number of scions were obtained from the gardens of the Royal Horticultural Society, Burnley, Victoria—Mr. George Neilson, the Curator, giving us every assistance in his power. In addition to obtaining scions from Victoria and our own Colony, a large collection of various fruits, amounting in all to over 300 varieties, was obtained direct from California. Some of the imported trees have been planted out, but in many cases the original trees are being kept as stock trees, and are being worked from. Amongst the trees from California was a very fine collection of olives, so that now we have at Wagga

the finest collection and the best varieties in Australia, as in addition to the Californian trees we have specimens of all the best trees that are at present growing in this Colony and also in South Australia.

In this part of the orchard about 4 acres has been set aside for drying fruits, the following varieties being planted—French prunes (both on Myrabolan and peach roots), apricots (Moorparks and Royals), peaches (Muir), and figs (White Adriatic). In addition to these it is also proposed to grow a few Alsace apricots, and Crawford's Early, Elberta, Susquehanna, and other peaches to test their drying value. A belt of almond trees will be planted on the upper or western side to act as a break-wind, the trees being set out, about 12 feet apart, so as to form a good shelter.

The northern portion of the orchard is divided from the experimental plots and nursery, of which more further on, and the trees planted 20 feet apart by a 30 feet central road, which runs directly east and west through the ground, and divides it into two parts—the one we have just dealt with, and the second or southern portion which I will now describe.

The upper part of the southern portion contains the nursery, where there are at present about 1,000 different varieties of fruit trees and vines, which will be permanently planted out next season, and a large number of stocks that will be budded this summer, and in addition it contains the experimental plots which are Mr. Valder's specialty. These plots, of which twelve are 66 feet square and twelve are 66 feet by 33 feet, are permanently laid off and staked with good roadways running through them, so as to allow of room for a horse to turn in cultivation. These plots are planted with a collection of over 600 varieties of fodder plants—pulses—and different economic plants, all of which are being carefully tested to determine their suitability or otherwise for this Colony, and any that are found to be of especial merit will be carefully kept, and when sufficient seed is available it will be distributed amongst the farmers of this Colony. This branch, alone, is of the greatest value, and will result undoubtedly in great good, as it is of paramount importance to every farmer to have definite and reliable information on every kind of farm crop or vegetable, and full particulars of the results obtained from these experimental plots will be published from time to time in the *Agricultural Gazette*. The working of these plots is done by means of the Planet, Jr., implements, a hand-power hill-dropping seed drill, a hand-power double-wheel hoe, and a horse-power cultivator being used. The land is well and deeply worked, and no pains are spared to keep it in the highest state of cultivation, as we depend mainly on thorough cultivation to produce good results.

Below the experimental plots we again come to the orchard, the trees on this side consisting of pears, plums, prunes, mulberries, quinces, persimmons, chestnuts, and miscellaneous—in all, about 1,000 trees—with a row of olives, 20 feet apart, on the west and south-west, for shelter. Below the trees are the vines. The ground was very irregular in shape; consequently it was not at all an easy matter to arrange the distribution of the trees so as to get each variety planted as far as possible in the most suitable soil. Still full consideration was given to this matter, and the results, I hope, will be fairly satisfactory. The work is at present being done by Mr. Valder and one regular man who has charge of the horses; and in addition to the work of the plots and nursery, the work consists mainly in keeping the land in a proper state of cultivation and free from all weeds, for which purpose a two-horse orchard cultivator—the "Top Notch," a drawing of which is shown in the *Agricultural Gazette* for September, 1893—is used. This implement was imported by the Department from America, and, without it, it would

have been impossible to do the work without a considerable increase of labour, as the season has been a most favourable one for the growth of weeds, and the ground, in addition to having been a sheep and cattle camp for years past, has had a very heavy seeding from the weeds that were allowed to grow up and go to seed on it. With this implement we are enabled to get over the ground rapidly and to do good work, and, as previously stated, it is on the thorough cultivation of the soil that we mainly depend, or I may say entirely depend, for retaining the moisture in the soil requisite for the successful culture of fruit in a hot and dry district.

So far there are only two permanent buildings erected—one a large shed, to be used as a seed-store, at present occupied by Mr. Valder as a dwelling, and a stable which we put up ourselves; but it is proposed to build a cottage for the manager and also one for the teamster, as well as accommodation for students, of whom a limited number will be taken. Students will have to be workers, and they will get a thorough insight into the working of an orchard and vineyard, including cultivation, pruning, propagating, spraying, thinning, gathering, grading, and packing fruit, as well as of fruit-drying, raisin-making, prune-making, and possibly canning and jam and jelly making. The latter will only be on a small scale, but the drying will be carried out on commercial lines, as it is probable that the 8 acres already planted with drying-fruits and raisin-grapes will be considerably extended, so as to make the orchard and vineyard in time self-supporting. In growing dried fruits the Department will not come into direct competition with the actual growers, as, if it is found that the fruit produced by the Department tends to injure the sale of that produced by the fruit-grower, it can be exported, and thus not come into competition with any local productions.

The drying operations will be carried out on the most complete lines, and full arrangements will be made for evaporating the fruit should the season prove unfavourable, or only partially favourable. Sun-drying will, however, be adopted whenever possible, the evaporator being used only when the season is unfavourable for sun drying. The best and most improved machinery for drying, grading, sulphuring, dipping, packing, raisin stemming and grading, will also be erected when the fruit is ready, so that students will have a chance of becoming thoroughly acquainted with all the details of fruit drying, and be able to start for themselves. It will be our endeavour to put up our fruit in the best manner possible, and to carry out the whole business so that it will be a credit to the Colony.

The large collection of trees that are being grown for experimental and reference purposes, will be of great value in correcting our very muddled fruit nomenclature, as the trees which comprise all or nearly all of the best standard varieties, will be true to name, and, when they have been proved, scions of any variety will be available for distribution amongst our fruit growers, so that if a fruit grower wishes to obtain a variety absolutely true to name, he can do so by applying to the Department, who will send him scions of the desired variety, if available.

Every care will be taken to keep down all insect and fungus pests, and the efficacy of different spraying materials will be carefully tested. A careful record of every variety grown will also be kept, especially as regards suitability, season, and freedom from or liability to disease, and this information, which will be of great advantage to intending planters, will be published in the *Agricultural Gazette* from time to time, and the great disadvantage under which we have hitherto been working, owing to the want of an orchard in which to carry out necessary experiments will be in a great measure overcome. The reasons for choosing Wagga for an experimental orchard, are—

firstly, the soil and climate may be taken as fairly representative of a large area of the Central Division of the Colony, so that the results obtained will not by any means apply solely to the Wagga district, but will be of more or less value to all the warmer and drier parts of the Colony.

The second reason is, that sooner or later fruit drying is bound to be a big industry in this Colony, and the districts that are best adapted for fruit drying are those that have a comparatively cool winter, a warm dry summer, and a fair rainfall (not less than 20 inches) where irrigation is not available. Wagga possesses these qualifications, and as a large area had been set aside for an experimental farm it was decided to have an experimental orchard and vineyard in addition. Students will thus have the opportunity of gaining a thorough knowledge of wheat growing and fruit culture in all their branches, and these two industries, wheat and fruit, are bound to be ere long two of the staple industries of the warmer and drier parts of this Colony. This is fully realised by the Department, and hence the starting of the farm, orchard, and vineyard, to give a thorough practical training to any young men who wish to take up wheat or fruit growing as a business. So far the work at the orchard has progressed satisfactorily, and all the trees, vines and plants are doing well. The showery spring has been very much in our favour, although it has given us a great amount of work to keep the weeds down, yet it has been of great assistance to the nursery, seed-beds and all young trees, &c. Having secured a good start, it will be our endeavour to make the place a thorough success, and as no trouble or labour will be spared to do so, and the management is in the hands of a man who does not know the meaning of the word shirking, there is every prospect of its being so.

Canning, Drying, and Preserving Fruit.

BY ALBERT H. BENSON.

IN response to a considerable number of inquiries respecting the best methods of disposing of our fruit, other than that of consuming it fresh, I will endeavour to explain, in as concise a form as possible, the methods of canning, drying, and preserving fruit, as it is by these means that we can utilise and conserve fruit that would otherwise be wasted. In addition to describing these processes of utilising fruits both commercially and for home use, I will also show the class of fruit best adapted for each purpose, and the best stage at which to gather it, according to the use for which it is intended.

1. Commercial Canning.

This is a business by itself, as distinct from fruit-growing as the milling of wheat is from the growing of the grain, and it requires expert labour and management to be a success. The average fruit-grower would in all probability fail to make it a success for several reasons, of which the following are some of the chief:—

First—A cannery to be made to pay must be run for as long a season and as economically as possible, so as to do the largest amount of work for the capital expended in buildings, plant, &c.; and nothing but standard or extra grades of reliable quality must be put up, so that a name can be made and maintained for the excellence of the output.

In the second place, a fruit-grower would be unable to keep up a constant supply of suitable fruit from any one orchard, unless the orchard was of large size, and so planted with a selected lot of fruits, especially adapted for canning, that a constant succession of fruits, extending over as long a time as the district would permit of, could be obtained.

In the third place, the fruit-grower would have to employ a skilled canner, as it would not be possible for him to attend properly to the working of the orchard, the gathering of the fruit, and the running of the cannery at the same time.

For these reasons, I do not recommend the average fruit-grower, without experience, to go in for canning as a business, as the probability is that it would end in failure. What I do recommend, however, is the establishment of co-operative canneries in the centres of our principal fruit-growing districts; these canneries to be run by thoroughly practical canners, and nothing but the best grade of fruit put up. In conjunction with the canneries, fruit-drying and preserving could be also carried on without any great additional expense.

The cannery should be of a size suitable to the requirements of the district, and, in my opinion, it will be better to have several small canneries in the centres of the different fruit-districts rather than one or more large canneries in Sydney, as with local canneries there will be less expense for carting the fruit and less damage to the fruit by bruising, the result of which will be a considerably greater proportion of first-class canning-fruit, and less culls, as a bruise spoils the fruit for canning. Too small canneries would probably not pay, but for about £500 a complete cannery, capable of putting up from 3,000 to 4,000 cases of canned fruit a season, could be erected, and the boiler-power necessary to do this would be sufficient to put up an equal amount of jam or jelly if wished. A drier or evaporator could be added to the cannery for an additional expense of £100 to £200, according to capacity and the requirements of the district.

A cannery of this size would consist of the necessary frame-buildings, can-making plant, 10 or 12 horse-power boiler, cooking-bath, steam-kettles, syrup-vats, cutting-tables, capping-tables, pitting-knives, parers, &c.—in fact, everything necessary for handling and putting up the fruit. The buildings need not be at all elaborate, as a plain frame-shed with a span-roof, say 60 feet by 40 feet, would be quite large enough to do all the pitting and peeling of the fruit, make the cans, cook the fruit or make jam, and, if wished, there would still be room for a dryer and for storing. A small shed adjoining would hold the boiler, and if more complete buildings were required, then stores for cases and timber as well as for the canned fruit could be erected.

Such canneries worked on co-operative lines as suggested are, in my opinion, the only way by which the fruit-growers of this Colony will be able to dispose of their fruit to the best advantage, as the fruit suitable for canning would then be canned, that suitable for drying would be dried, and that suited for using fresh would be disposed of locally, or exported if there was a suitable surplus available.

The process of canning may be briefly described as follows:—The fruit, on arrival at the cannery, after being weighed, is given to the women at the cutting-tables. In the case of peaches the first operation is to peel them, and this is usually done with a peach-peeler, of which the "Scott" peach-peeling machine is one of the best; or if the peaches are of very irregular shape, then they are peeled by hand, using a sharp knife for the purpose. After peeling, the pit is taken out; in the case of a free-stone this is easily done—a clean cut is made longitudinally right round the fruit, and the stone then taken out; but in the case of cling-stones, specially-made pitters, of which the California cling-stone pitter is a very good type, are used, or if not, then a pitting-spoon or a cling pitting-knife is used. The latter are now I believe, obtainable in Sydney at a reasonable price. After the stone is removed, if there is a large amount of red round the pit that still adheres to the flesh, then it must be spooned out, as if left in it would colour or stain the syrup and render the fruit unsalable.

The fruit, as cut, is carefully sorted into the different grades. All the large, firm, whole pieces are placed by themselves; all the smaller; unripe, over-ripe, and broken pieces being kept out for pie-fruit or fruit-pulp. The fruit, when cut, is taken to the filling-tables, the best fruit being placed in 2½-lb. cans (which are 4 inches in diameter by 4¾ inches high), and the pie-fruit placed either in 2½-lb. cans or in larger cans holding about 11 lb. of fruit nett, which are about 6¼ inches in diameter and 9¼ inches high. Pie-fruit put up in the large cans is similar to the fruit-pulp recently received by the Department of Agriculture from England, and it only differs from ordinary canned fruit in that no sugar is used for its preservation.

After the cans are filled with fruit, cold syrup, made by dissolving the best crystalline cane-sugar in boiling water, is added till the can is completely filled with fruit and syrup, when it is taken to the capping-table and the lid soldered on, a small vent-hole in the centre of the cap being left.

The strength of the syrup varies according to the quality of the fruit to be put up, but all standard and extra grades should be put up in a good heavy syrup, made by dissolving about 4 lb. of sugar in each gallon of water. In addition to the sized cans mentioned, some Californian packers put up a very choice line of extra grade in 8-lb. cans (which are 4¼ inches in diameter by 4¾ inches high), but it is not a common size, and is only put up for the very best trade. The can is now placed in an iron frame or basket, which may hold anywhere from six to a gross cans, according to the size of cooking-bath, and is then submerged in boiling water long enough to drive off every particle of air contained in the can.

The vent-hole is then soldered up and the fruit cooked till it has reached the right consistency. It is in the cooking of the fruit where expert knowledge comes in, and no hard-and-fast rules can be laid down. It is simply a question of practical experience, and depends entirely on the kind of fruit, its ripeness, texture, and cooking qualities; for whereas one fruit would cook to mush in five minutes and be valueless, another will require twenty minutes, or longer, to be properly cooked and to acquire its full flavour.

Apricots are treated the same as peaches, except that the skin is left on, and too great care cannot be taken to cut the fruit well. Never cut one side and break the other, leaving a ragged edge, or the fruit will never look well—and looking well goes a long way towards selling the fruit. Pears are peeled by hand, cut in half, the cores removed, and then treated similarly to peaches. Plums are, however, treated quite differently. The pits are not removed, but the fruit is carefully graded for size and ripeness, then placed in the cans, the syrup poured on, then the lid is soldered on, but no vent-hole is left. The fruit is now cooked as usual, sufficiently long for the pressure inside the can to burst the air surrounding the pit of the plum, but of course not long enough to burst the can. The can is then taken out, a spile-hole driven into it to allow the air to escape, and as soon as all the air is exhausted the tin is soldered up and the cooking finished.

All cans after being cooked are carefully tested to see that they are absolutely air-tight, and all defective cans, after the leak has been mended, are again raised to the boiling-point, as no fruit will keep unless it is absolutely air-tight. The testing is easily done, an expert canner knowing at once from the sound of the can when struck whether it is air-tight or not; and the cans can also be easily tested by submerging them, after they have cooled for two or three seconds, in boiling water, when if the smallest flaw exists the air will be seen escaping from it. The remainder of the work is merely finishing, and consists in dipping the ends of the cans, to coat them with blue, bronze, or gold—which improves the appearance of the can; labelling, for which purpose a good showy litho. should be used; and finally packing for the market in cases holding twenty-four cans.

The pie fruit is differently treated to the canned fruit, and as there has been a considerable number of inquiries respecting the manufacture of fruit-pulp—which is only another name for pie-fruit—I will explain how it is made.

As previously mentioned, all the small under-ripe fruit and broken pieces unfit for the standard grade are placed in cans holding about 11 lb. nett. When filled with fruit as tightly as possible without crushing, water is added to cover it, the lid is put on, and a vent-hole left. The can is now placed in

boiling water till the whole of the contents are raised to boiling-point, and all the air in the can has been driven off, when the vent-hole is closed, and the cooking is complete. The cans are tested the same as for canned fruit. Another process, and that evidently adopted in the case of the can of apricot pulp received by the Department from London, is as follows:—The fruit, after being cut, was all placed in the can with the cut side down, and was evenly and tightly packed, the lid being off enabling this to be done. Water was now added to cover the fruit and the can placed in a shallow vessel of boiling water, the water only coming to within about 1 inch of the top of the can. When the fruit inside the can had been raised to a sufficient temperature to drive off all the air, the lid was put on—being crimped on, not soldered—and the pulp was ready. The value of fruit-pulp is that it is a cheap means of preserving the inferior fruit that is not good enough for canning, and enabling it to be kept over to such a time as it is convenient to turn it into jam. There is one thing, however, that I must caution my readers against in making fruit-pulp, and it is this: No fruit that is unsuitable for canning, except as regards size or under-ripeness, is suitable for pulp, as it must keep its shape when cooked and not go to mush. The time to cook pulp is about twenty-five minutes, as it takes that time to get the can heated right through.

The fruits that are suitable for canning must possess the following qualities:—Firmness of flesh, which must be of sufficient consistency to keep its shape when cooked; clearness of flesh—either white or yellow-stained flesh is unsuitable; and good flavour, which is brought out by cooking. The fruit, in the case of stone-fruits, may be either cling or free stone, but as a rule cling-stones are to be preferred, as the flesh is usually firmer than that of free-stones, and consequently keeps its shape better The fruit should be of large size, and be gathered when fully grown, but before it begins to soften, as it will not keep its shape in cooking if over-ripe. The fruit requires to be carefully gathered and handled, so as to be bruised as little as possible, and it should be brought from the orchard to the cannery with the least delay. The following are some of the best varieties of canning-fruits:—

Peaches.—Free-stones, Flesh, yellow: Crawford's Early, Muir, Lovell· *Free-stones, Flesh, white:* Morris White. *Cling-stones, Flesh, yellow:* Turkena, Lemon Cling, Orange Cling, Nichols' Orange Cling, Henrietta, Yellow Italian, and several of the local seedlings of the Yellow Italian type. *Cling-stones, Flesh, white:* Lord Palmerston, Shanghae, Large White Cling, Heath Cling, George's Late Cling, and several local seedlings of the Shanghae and Newington types.

Apricots.—Any good apricot will can, but a very large proportion of our locally-raised apricots are worthless for canning, as they do not pit easily; clinging in parts, they contain a mass of stringy fibre, a large amount of free acid, and finally, when cooked, go all to mush. Though heavy croppers, they are worthless fruit, as they are no good for canning, drying, or jam-making, and are a very inferior fruit fresh. For canning, high-flavoured, perfect free-stones of large size and firm texture should be chosen, and the varieties that possess these qualifications are the Royal, Moorpark, Peach, Blenheim, and most varieties of the Moorpark type. Where the Moorpark is a free bearer it is the best apricot to grow for any purpose.

Plums.—Only pale-skinned plums are suitable for canning, and none except those of first-class quality and firm texture should be used. The following are some of the best canning-plums:—Jefferson, Reine Claude de Bavay, Washington, Greengage, White Magnum Bonum, and Coe's Golden Drop.

Pears.—There is one great canning-pear, Williams' Bon Chrêtien—or, as it is called in America, the Bartlett—but there are other pears which will can, amongst which Doyenne Boussock shows considerable merit, as it is usually a heavy bearer of large, even-sized fruit and is a strong-growing and very healthy tree. In canning pears, always choose fair-sized fruit that has not commenced to soften, but yet not immature, or the fruit will be woody.

Cherries.—Only pale cherries are suitable for canning, and the firmest fruit is chosen. The varieties that are best suited for canning are the Napoleon Bigarreau, Florence, and Centennial, though all the pale Bigarreau varieties will can well.

Blackberries.—This fine fruit, which is almost entirely neglected in this Colony, cans well; the varieties best adapted for canning being the American kinds, Lawton and Kittatinny.

Quinces also can well, being treated similarly to pears, but it is questionable if there would ever be anything more than a local demand for this fruit, which is by no means a popular one in America or Europe; any variety will can.

Nectarines are treated as apricots, that is to say, they are not peeled like peaches. Only white or pale nectarines are suitablo for canning, the following varieties being two of the best:—New White Free-stone and White Cling.

Grapes can also be canned, but only white varieties should be used. The berries, which should be large and firm, with a thin but tough skin, should be cut from the bunch, and all imperfect or damaged berries carefully excluded. The variety most commonly canned is the Muscat of Alexandria, or, as it is often called, the Muscatello Gordo Blanco, though grapes such as the Camden sherry, Duke of Buccleuch, Malaga, and Dooradillo should also can well.

Several other fruits, such as pineapples, &c., also can well, but those that I have mentioned are, I think, all that are of any great importance to the New South Wales fruit-grower.

2nd.—Home Canning.

Every person having an orchard should put up enough fruit during the season to supply all home requirements, as the process is by no means a difficult or costly one.

The kinds of fruit that are suitable, and their methods of preparation, I have fully described under the head of Commercial Canning, so I will confine my remarks to the methods of conserving the fruit. In the place of cans, glass jars of different sizes and patterns are used, and the following jars (all of which are obtainable in Sydney) may be used, viz.:—The Lightning, Chicago, San Francisco, Mason's, and one or two others. After the fruit has been prepared as previously described, it is treated in one of the two following manners:—

1st. It is placed in a wide and shallow copper or enamelled vessel, and syrup or water and sugar is added to it. The fruit is then slowly raised to the boiling-point, but not allowed to boil vigorously, or it would go to pieces, and placed whilst boiling hot in the jars, which should have been previously heated in order to prevent their being cracked by the hot fruit, and the covers at once put on, as, in order for the fruit to keep, it is necessary that there is no air present in the jars. In order to be sure of this, it is always well to test the jars first by filling them with water; then put on the lid and

turn them upside down, when it will be easily seen if they are not air-tight. If not air-tight, a new rubber should be put on, and the jar again tested. In taking the fruit from the vessel in which it has been cooked, and placing it in the jars, great care is necessary to prevent the fruit from crushing, and so lose its shape. If wished, the fruit can be cooked with water without any sugar, but I do not like the method, as it is no cheaper in the end, sugar having to be added to the fruit before it is fit to use; and in the case of any fruit that is cut or peeled nearly the whole of the flavour goes into the juice, and the fruit itself has about as much flavour as a turnip.

2nd. The second process, and the one that I advise everyone to adopt, is to place the fruit in the jars before cooking and cover with syrup, as is done in the case of cans, the fruit being evenly and well arranged in the jar—a jar having the mouth sufficiently large to admit the hand freely being the best for the purpose. The jars filled with fruit and syrup are now placed in a large oval boiler or other suitable vessel, having a false perforated bottom or some lattice-work to fit the bottom and prevent the jars coming into contact with the metal bottom, which will prevent their being broken during the cooking. Cold water is now added to the vessel until it reaches the necks of the jars, when it is slowly heated to the boiling-point, at which stage the fruit should be sufficiently cooked. The lids are placed on and fastened down as quickly as possible, and care must be taken to see that they are absolutely air-tight, as the fruit will not keep otherwise.

There is a local demand for first-class fruit put up in glass, but it must be nothing but first-class, when it will bring a very remunerative price, as there is a certain class of Sydney buyers who prefer to buy fruit in glass, and who will pay a good price for a fancy article—so that it will pay to cater for this trade.

Drying.

The subject of fruit-drying is one that to be properly treated would require a series of articles; but in order to keep this article within reasonable limits I must condense it, so as to make it as concise as possible. In the first place, fruit is dried by two methods, viz., sun-drying and machine-drying or evaporating, and though the preparation of the fruit is the same in both cases, the after-treatment is quite different.

1st.—Sun-drying.

Sun-drying can only be depended upon in districts that have regular seasons of rainfall and dry weather, and where the air is dry and the nights dewless, as though fruit is sun-dried in districts having heavy dews the quality is never as good as that produced where the nights are dewless. In many of the western and north-western districts of this Colony sun-drying could be generally depended on, and in many of the districts in the central division it could always be partially depended upon; but an evaporator would be necessary to finish the drying in case of the weather breaking.

The preparation of the fruit depends on the variety—thus apricots are allowed to remain on the trees till fully ripe, yet not so ripe as to run when cut. The fruit is carefully gathered and taken to the cutting shed, where it is cut into halves and the pit taken out—the fruit being cut right round, not one side cut and the other torn. As cut the fruit is placed on the drying trays with the cut side up, and as the trays are filled they are taken to the sulphurer and the fruit sulphured so as to keep its bright yellow colour when drying. The size of the trays used is generally 2 ft. x 3 ft. with

a cleat 1 in. x 2 in. at the ends; but much larger trays are sometimes used. The trays fit the sulphurer, which is of a size suitable to the requirements of the orchard, and, where there is a large quantity of fruit to dry, the trays, as filled, are stacked on a tram waggon which, when full, is run into the sulphurer and sulphured, thus saving a handling. The sulphurer is an air-tight box with cleats on the sides on which to rest the trays, and when full a quantity of sulphur is placed in the bottom and ignited, the fruit being kept in the fumes a sufficiently long time to fix the colour, but not to injure the fruit by over-sulphuring. The time of sulphuring varies from half-an-hour to several hours, according to the condition of the fruit and the amount of sulphur used—some growers using a good deal of sulphur and only exposing a short time, and others, as at Mildura, using a small amount of sulphur but giving the fruit a long exposure. The sulphuring should only be long enough to fix the colour of the fruit, as any exposure beyond this only tends to injure the quality of the fruit. Over-ripe fruit can be brought back to shape by over-sulphuring, but, according to Professor Hilgard of the University of California, the fruit is considerably injured by so doing. Sulphuring is really no good to the fruit—in fact, at its best, it is more or less injurious; but the public require a high-coloured dry fruit, and in order to produce it sulphur must be used. After leaving the sulphurer, the trays are placed in the sun to dry, the drying ground being kept as free from dust as possible, and having a good exposure to the sun. At Mildura, the drying grounds are planted with lucerne, which is cut just before the trays are put out. The trays thus rest on the stubble and not on the ground, and the danger of scorching the fruit is done away with; and, in the second place, there is much less chance of injury from dust. In any case, the drying ground should be well sheltered from dust, as dust spoils both the appearance and selling of the fruit. The fruit is left on the trays till properly dry, a state that is only learnt by experience; but it may be explained by saying that the fruit must not be so dry as to rattle on the trays like bones, or so moist than when worked up between the finger and the thumb, moisture can be extracted, but a medium of the two. After the fruit is sufficiently dried on the trays, it is taken to the dry-fruit room, where it is placed in a heap on the floor to sweat, the fruit being turned every day with wooden shovels. The fruit-room should have all the windows and doors covered with fine wire gauze, so as to keep out all insects, especially the dry-fruit moth, which would lay eggs on the fruit and render it wormy. During the sweat the fruit evens up very much, and the fruit that was over dried takes the moisture from that not enough dried, and the whole sample becomes of an even texture, when it is ready for packing. If there is any fear of fruit-moth, weevils, or other insects, it is a good plan to dip the fruit for a few seconds in boiling water, which will kill all insect eggs that may be on it, and then rapidly dry and pack. The fruit is packed in boxes holding 25 or 50 lb. or in strong clean cotton sacks. In packing in boxes, always face the bottom layer, using fruits that have been flattened by passing through rollers for the purpose. Line the box well with good-quality paper, and place a good litho. on the faced layer, which on opening the case will be the top and not the bottom, as it always pays to pack the fruit so as to look as attractive as possible when opened. The fruit should be carefully graded for size, large and small fruits never being packed in the same box. The first grading should take place before the fruit is cut, it being always best to have all the fruit on the tray of nearly an equal size, as it dries evener and better than if big fruit and little fruit are dried together. A second grading should be given when the fruit is dried. Peaches, like apricots, should be quite ripe when dried, and they are

either peeled or unpeeled, but where possible it always pays to peel the best grades of peaches, as the fruit always commands a much better price than unpeeled. In order to pay, peeling must, however, be cheaply done, and there are two methods by which this can be accomplished, one of which is by the use of lye, and the other by hand-peeling after the fruit is sulphured. In order to peel the fruit by means of lye—a boiling solution of caustic soda, one pound of caustic soda to ten gallons of water is prepared, and the fruit immersed in it for two or three seconds, when the skin may be readily rubbed off. Great care must be taken not to dip too long, and also to thoroughly rinse the fruit after dipping in cold fresh water, or the lye will turn the fruit dark. Hand-peeling is only practicable with certain varieties, such as the Muir and Elberta, the skins of which are easily and quickly removed by the fingers after the fruit has been sulphured.

Pears and apples are prepared for drying by being peeled, sliced, and cored, several machines which do the work rapidly and well being used for the purpose. These machines are obtainable in Sydney at reasonable rates. The fruit is then sulphured and dried.

Figs are dried in several ways but none of them come up to the Smyrna method, where the fruit is allowed to remain on the trees till dead ripe, then dried in the sun without any dipping or sulphuring, and when dry packed for market. The complete process I hope to give at some future time in an article devoted to fig culture and curing.

For prune drying I will refer to my article on the subject that was published in the *Agricultural Gazette*, October, 1892, and for raisin drying I will refer to Mr. Despeissis's article in the *Agricultural Gazette* for January, 1893.

Fruit in order to be suitable for drying must possess the following qualifications:—The flesh must be firm and meaty and the juice rich in sugar in order to produce a heavy dried fruit, and the fruit should in no case be dried till thoroughly ripe, or it will weigh light and be of inferior quality. The following are some of the best drying fruits:—

Peaches, Free-stones.—Crawford's Early, Lady Palmerston, Muir, Salway, Crawford's Late, Susquehanna, Comet. Yellow-fleshed free-stone peaches having red at the pit are usually preferred, though any of the yellow cling peaches that are good canners also dry well.

Apricots.—The Moorpark leads, drying heavier than any other apricot, but all those mentioned as suitable for canning can also be dried. The Alsace, an apricot of the Moorpark type, is said to be giving great satisfaction as a drier and also to be a regular and heavy bearer.

Plums.—In addition to the various prunes used for drying, several varieties of plums dry well, the following being of especial merit:—De Montfort, Prince Englebert, Angelina Burdett, and Coe's Golden Drop.

Pears.—The best drying pear is the Williams' Bon Chrétien, as it retains its full flavour.

Apples.—The following varieties dry well:—Gloria Mundi, Granny Smith's Seedling, Cat's Head, Mobb's Royal.

2nd.—*Evaporating or Machine-drying.*

Where the sun heat cannot be depended upon to dry fruits, recourse must be had to machine driers, and these may be of any size, from the small family evaporator, capable of drying from 3 to 5 bushels of fruit per diem, to the large factory driers, capable of turning out several hundred bushels daily.

All evaporators consist of three distinct parts, the furnace, the heating-chamber, and the fruit-drying chamber. The furnace is filled with draughts that can be opened or closed so that the temperature can be raised or lowered at will. The heating-chamber is situated immediately above the furnace, the outside air being drawn in through specially-arranged draughts, heated, and then passed either over or through the fruits on the trays—the amount of hot air passing over the fruit being easily regulated by means of the draughts. The fruit-drying chamber is either horizontal, as in the case of the "American" evaporator or upright, as in the "Phillips," "Pearson," and "Zimmermann," and is filled with cleats on which the trays containing the fruit rest. The trays vary in size according to the size of the evaporator, and are usually made of strong galvanised netting of half-inch mesh. The trays are raised and lowered by several different mechanical contrivances, and the fresh fruit is either placed in the bottom and gradually raised to the top, when it is ready, or, as in the case of the "American" evaporator, it is placed first at the lower end, and travels along to the upper, and is finally returned to the lower end and taken out. In some evaporators a steady sun temperature of about 180° is maintained, and in others, air, at a much greater temperature, is rapidly passed over the fruit, but in no case must the fruit be cooked, the object being simply to remove the superfluous water, and to retain the natural colour of the fruit. Most evaporators are easily worked, and do fair work; the chief care should be devoted to keeping up an even temperature, and seeing that no part of the machine becomes over-heated, and the fruit, in consequence, burnt. A little experience will enable any man of average intellect to work an evaporator, and, if good fruit is chosen, to turn out a marketable article.

In fruit-drying there is no greater mistake than trying to dry culls; rubbish will, no doubt, dry after a fashion, but when dried it is nothing but skin, and of no value, whereas good fruit, well dried, packed, and showily got up, will sell anywhere. Fruit-drying, instead of, as at present, being practically unknown, should be a great and paying industry, and instead of our having to import dried fruits to the extent of over £100,000 per year, we should be able to supply all our own wants and have a good surplus for export.

Jam-making.

No matter how well the orchard is kept, and the trees thinned, there will always be a certain proportion of small fruit which is of no value for canning or drying, but yet will make a good jam—though first-class jam, like first-class canned or dried fruits, should be made of selected fruits, and when making for home consumption, I should always advise its use. However, the smaller fruit makes a good jam if used when fresh, and not allowed to ferment and become partially rotton before using. The process of jam-making is a very simple one, whether for home use or at the factory. The fruit, which is best not to be over ripe, and which should be free from all rotten fruit and other rubbish, is placed in a steam-jacketed kettle, and to every 1 lb. of fruit not less than three-quarters of a pound of the best cane sugar should be added. The fruit is then rapidly boiled till of the right consistency—that is to say, will keep its shape if up-ended when cold, and then poured into cans or glass jars and covered down at once whilst quite hot, as, in order to prevent mould forming on the fruit, it is necessary for it to be perfectly air-tight. If not sufficiently boiled, the fruit is apt to ferment, so it is always best to thoroughly cook it. When using cans, those

holding about 1 lb. are used, and the size is about $2\frac{1}{4}$ inches in diameter by $3\frac{1}{4}$ inches high, and when using glass, 1-lb. jars are generally used, which are either corked or tied down with parchment-paper; but whatever material is used to cover the jam, it is absolutely necessary, if the jam is to keep well, that it be perfectly air-tight. When jam is made for home consumption, and steam-jacketed boilers are not available, cook the fruit in shallow, wide vessels, either of copper or iron, lined with enamel, over a slow fire, stirring constantly to prevent burning, and removing all impurities that rise to the surface in the form of scum. Always use the best cane sugar—confectioners' crystals is about the best—as the jam will be clearer, firmer, and keep better than that made from a cheaper and inferior sugar.

The Ayrshire Breed of Cattle.

By J. L. THOMPSON.
Principal, Hawkesbury Agricultural College.

Origin.

There are several theories as to the origin of this now famous breed of dairy cattle. Some writers say they are the result of a cross between the Shorthorn and the Jersey; others that they arose entirely from a careful selection of the best of the native breeds of Ayrshire, the county in the south-west part of Scotland, from which they take their name. I consider that the following communication, which appeared in the *Australasian*, under date, 9th September, 1893, should put the question as to the origin of these cattle at rest:—

[*To the Editor of the Australasian.*]

Sir, Glen Wallace, Poowong, Victoria, 4 September, 1893.

In the *Australasian*, of 2nd September, Thistledown propounds one or two theories as to the origin of the Ayrshire breed of cattle. The following has been handed down to me as the origin of these cattle. My greatgrandfather John Dunlop, of Dunlop, about the year 1740, put a Devon bull to some Guernsey cows, and a Guernsey bull to some Devon cows. Selection was made and re-crossed from which crosses sprang the renowned Dunlop or Ayrshire cattle. It is a matter of family history that the foregoing is the true origin of the Ayrshire cattle.

Yours, &c.,
J. A. WALLACE DUNLOP.

It is well known that this breed of cattle were known in Scotland for many years as the Dunlop strain, and I think the above should be accepted as the history of the true origin of this now celebrated race of dairy stock.

The Ayrshire of a hundred years ago was very different from the best specimens of the present day. They were small, inferior, irregularly shaped, but hardy animals. The Ayrshire of the present day is an animal of extreme beauty.

The following ingenious versification of the points of an Ayrshire cow are based on a document published, under the authority of the Ayrshire Agricultural Association, and taken from the 8th volume of the "Transactions of the Highland and Agricultural Society of Scotland":—

Would you know how to judge of a good Ayrshire cow?
Attend to the lesson you'll hear from me now.
Her head should be short and her muzzle good size,
Her nose should be fine between muzzle and eyes,
Her eyes full and lively, forehead ample and wide,
Horns wide, looking up and curved inwards beside.

Her neck should be a fine tapering wedge,
And free from loose skin on the undermost edge,
Should be fine where 'tis joined with the seat of the brain,
Strong and straight upper line without hollow or main.
Shoulder-blades should be thin where they meet at the top,
Let her brisket be light, nor resemble a crop;
Her forepart recede like the lash of a whip,
And strongly resemble the bow of a ship;
Her back short and straight, with the spine well defined,
Especially where back, neck, and shoulders are joined;
Her ribs short and arched, like the ribs of a barge,
Body deep at the flanks, and milk-veins full and large;
Pelvis long, broad, and straight, and in some measure flat,
Hock-bones wide apart, and not bearing much fat,
Her thighs deep and broad, neither rounder nor flat,
Her tail long and fine and joined square with her back,
Milk-vessels capacious and forward extending,
The hinder-part broad and to body fast pending.
The sole of her udder should just form a plane,
And all the four teats equal thickness attain,
Their length not exceeding two inches or three,
They should hang to the earth perpendicularly,
Their distance apart when they're viewed from behind,
Will include about half the udder you'll find,
And when viewed the side they will have at each end
As much of the udder as 'tween them is penned.
Her legs should be short, and bones fine and clean,
The points of the latter being quite firm and keen,
Skin soft and elastic as cushions of air,
And covered all over with short woolly hair;
The colours preferred are confined to a few,
Either brown and white checkered or all brown will do.
The weight of the animal leaving the stall
Should be about five hundred sinking offal.

Points of a Modern Ayrshire Cow.

The head should be small, but rather long and narrow at the muzzle; the eyes small, but sharp and lively; the horns small clear crooked, and their roots at considerable distance from each other; neck long and slender, tapering towards the head with no loose skin below. Shoulders thin, fore-quarters light; hindquarters large, back straight, broad behind, the joints rather loose and open, carcase deep, and wide over the hips, with round fleshy buttocks; tail long and small; legs small and short, with firm joints, udder capacious, broad and square, stretching forward and neither fleshy, low hung, nor loose. The udder is a good guide in judging the milking qualities of a cow. It should in form be long from front to back, stretching well forward on the belly, broad behind, filling up well the space between the legs, but should not be too deep vertically—that is hang too far down.

The milk-veins large and prominent. Teats short all pointing outwards and at considerable distance from each other, skin thin and loose, hair soft and woolly, and the general figure compact and well formed. I also attach a great deal of importance to the escutcheon which ought to be wide and run up to the pelvis.

The following are the points of the Ayrshire cow and their values in judging in the show ring, taken from a report by a committee of the Herd-book Society. The points of the bull only vary in the matter of masculine characters, which, according to the general rule, ought to be distinctly defined.

	Points.
1. Head short; forehead wide; nose fine between the muzzle and eyes, muzzle large; eyes full and lively, horns wide-set on, inclining upwards	10
2. Neck moderately long, and straight from the head to the top of the shoulder, free from loose skin, on the under side fine at its junction with the head and enlarging symetrically towards the shoulders	5
3. Forequarters—shoulders sloping, chest sufficiently broad and deep to ensure constitution; brisket and whole forequarters light; the cow gradually increasing in depth and width backwards	5
4. Back short and straight; spine well defined, especially at the shoulders; ribs short and arched; body deep at flanks	10
5. Hindquarters long, broad and straight; hook-bones wide apart, and not overlaid with fat; thighs deep and broad (but thin of flesh on inner thigh or twist); tail long, slender, and set on level with the back	8
6. Udder capacious, and not fleshy, hinder part broad (and rounded, like the side of a cheese); the whole firmly attached to the body; the sole nearly level, and extending well forward; milk-veins well developed; teats from 2 to 2½ inches long, equal in thickness, and hanging perpendicularly; distance apart at the sides, equal to one-third of the length of vessel, and across to about one-half of the breadth; small teats are now considered most objectionable, both in the market and the show-ring	33
7. Legs short in proportion to size; bones fine, and joints firm	3
8. Skin soft and elastic, and covered with soft, close, woolly hair...	5
9. Colour red, of any shade, brown or white, or a mixture of these, each colour being distinctly defined; brindle or black and white is not in favour ...	3
10. Average live weight in full milk about 10½ cwt.	8
11. General stylish appearance and movements...	10
Perfection	100

The Ayrshire is essentially more of a milk producer than a beefer, although they may readily be turned into beef. The most valuable quality that a dairy-cow can possess is that she yields much milk, and that of an oily or butyraceous nature, and that she is of some value to the butcher as well.

Ayrshire Bullocks make good beef at three years old.

The Ayrshire has been termed a general purpose dairy cow, and the general average for a milking season is about 560 gallons, and as much as 750 gallons, and even 1,000 gallons, have been reached from individual cows. Some extraordinary records have been made of the quantity of milk given by noted Ayrshires. A young Ayrshire belonging to Mr. Finley, near Glasgow, gave 9 gallons daily for six months after calving. This, reckoned at 6d. per gallon (not too much for milk in a large city) amounts to a little over £40. This cow, as subsequently sold, to go to America, and her female progeny, all turned out most satisfactory milkers, and were much sought after by dairymen of that country.

The Ayrshires are good foragers, hardy constitutioned, as a rule, free from disease and reliable breeders. They are of lively habits. The bulls sometimes are of a spiteful and pugnacious disposition, and are ever ready to gore each other, and are not very safe with human beings. They should accordingly be kept at a distance. More Ayrshires can be kept on the same

quantity of food than other breeds. Three Ayrshires, as a rule, will eat about the same as two ordinary Shorthorns, and, generally speaking, two good Ayrshire cows will give as much milk as three Shorthorns.

As to the quality of the milk, it is especially valuable for cheese-making, on account of the smallness of the globules. The cream globules of the Jersey breed are large, and, on this account, are especially valuable for butter-making. Although the cream globules of the Ayrshire are small, they are by no means deficient in butter-fats, but, being smaller, separate less readily from the milk.

Professor Brown obtained from 134 separate tests of the four following breeds of cattle, these results :—

	Water.	Fat.	Solids (other than fat).
Ayreshire	88·20	4·60	7·20
Holstein	87·45	3·35	9·00
Jersey	84·55	7·35	8·10
Shorthorn	85·17	5·63	9·20

The Ayrshire gives an average of 13·7 of cream, and 42·41 per cent. butter from cream. The Holstein only gives 10·24 per cent. of cream, and 30·87 of butter from that cream. The Jersey gives 16·36 per cent. of cream, and 52·17 of butter-fat from that cream. The Shorthorn gives 14·6 per cent. of cream, and 47·80 of butter from that cream.

The Ayrshire breed of cattle have been introduced with success into almost every civilised land, and some of the very best strains have been introduced into Australia and New Zealand. In that Colony, where Scotch settlers predominate in a district, the Ayrshire cow may generally be found, and some of these animals are of excellent quality. A remunerative trade between New Zealand and the Australian Colonies has been carried on for several years, but this has been over-done of late, and it is now somewhat difficult to dispose of shipments, either in this Colony or Victoria, at prices that will pay expenses. Although numerous excellent animals have been introduced here from New Zealand, notably, those purchased of Mr. K. B. Fergusson, Waitate Farm, Dunedin, still it must be admitted that a large number of inferior beasts have also found their way here.

Magnificent specimens of the Ayrshire breed have been imported direct from Scotland to this Colony by Mr. J. E. Pemell of Randwick, and Mr. Samuel Hordern, of Sydney. The last-named gentlman's champion bull, "Hover of Southwick," imported from Scotland, and bred by Sir Mark Stewart, of Scotland, is perhaps the finest specimen of a modern Ayrshire sire in the Colonies. Mr. Pemell imported the magnificent bull, "Duke of Randwick," 342, A.H.B., bred by the Duke of Buccleuch, K.G., Drumlanrig. He was exhibited at the National Agricultural Soci[illegible] Show, Melbourne, 1883, and was awarded first prize and champion and [illegible] Government grand champion prize of Australia as the best Ayrshire [illegible] In 1884 the same honours were awarded to him. The late Mr. Rich[illegible] Gibson, of Victoria, purchased "Duke of Randwick" from Mr. Pemell; [illegible] some of the best Ayrshires in Victoria trace their origin to this famous [illegible] He also purchased at the same time "Ada," of Drumlanrig, imported, A.H.[illegible] 617, and the "Duchess of Randwick" for the high price of 500 guineas. "Ada" of Drumlanrig was bred by Mr. Andrew M'Dowall, Auchtralure, Stranrear, Scotland, from whom she was bought by the Duke of Buccleuch, K.G., Drumlanrig, for his herd. This magnificent animal has never been beaten in a show yard, having won nine prizes, viz.:—First as a one-year-old at Highland Society's Dumfries Show, 1878; first as a one-year-old at Rhins of Galloway Society's Stranraer Show, 1878; first as a one-year-old at Dal-

beattie, 1878; first as a two-year-old at Ayr, 1879; first as a two-year-old at Glasgow, 1879; first as a two-year-old at Highland Society's Perth Show, 1879; first as a two-year-old at Dumfries Show, 1879 (vide A.H.B., vol. III); and never shown as a three-year-old. At the Sydney Agricultural Society's Show in April, 1882, she was easily placed first, competing against imported and colonial-bred Ayrshires; at the National Agricultural Society's Show, Melbourne, 1882, first as the best Ayrshire cow, since which she has not been exhibited, thus having an unbeaten record.

The following are some of the principal exhibitors of Ayrshires at our metropolitan shows:—The Bodalla Company (Limited); Messrs. Samuel Hordern, J. M. Antil, E. M. Dietrich, T. N. Grierson, J. F. Montgomery, F. Murphy, F. A. Mackenzie, J. E. Pemell, F. L. Peate, A. Bennet, and others.

The following are some of the leading breeders of Ayrshires in Victoria:—Messrs. W. B. Cumming, Mount Fyand; E. Rowlands, Ballarat; David Mitchell, Lilydale; M'Nab Brothers, Tullamarine; John Bond, Green Vale; C. N. Smyth, Bloomfield; John James, The Willows; J. A. Cochrane, Geelong, Robert Buchanan, Berwick; and others.

Ayrshires at the Hawkesbury Agricultural College Farm.

The foundation of a small herd of Ayrshires was laid in 1891 by the purchase of eight heifers bred by H. H. Brown, Esq., M.P., "Coulston," Paterson.

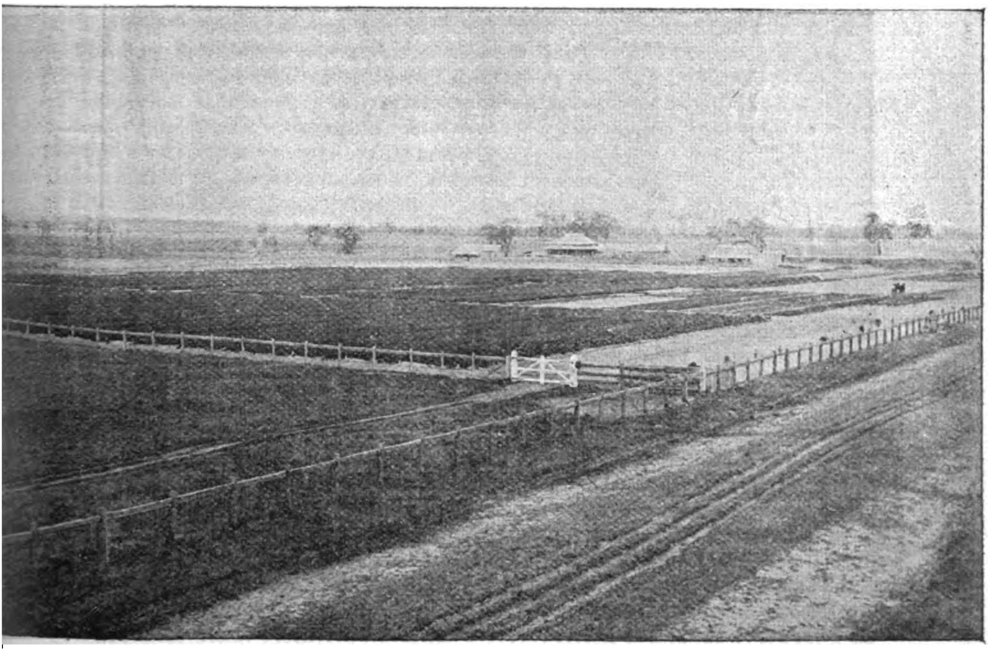


Fig. 1.—Experimental grounds, showing saw-mill, dairymen's cottage, dairy milking-sheds, and silo.

They were by such sires as Sir Walter Scott, by Teviot, by Baron II of Drumlanrig. Young Baron also by Baron II, of Drumlanrig (imported).

These heifers were in calf to Cock-a-bendy, by Baron Oxhill, imported; by Baron Bucklyire, who was never beaten in Scotland, and was champion of the yard when 21 years old.

These heifers have done remarkably well here, and their progeny are turning out fine specimens of the breed. At the same time the bull Warrior, 2 years and 11 months old, was purchased, having just arrived from New Zealand.

Warrior is by Carlo, by Baron Oxhill, grand sire Baron Oxhill (imported); d Wee Nannie, by Scotchman; g d Nannie, by Neil; g g d Nelly Miller, by Dandy; g g g d Nelly Miller first, by Ayrshire Jack (imported.)

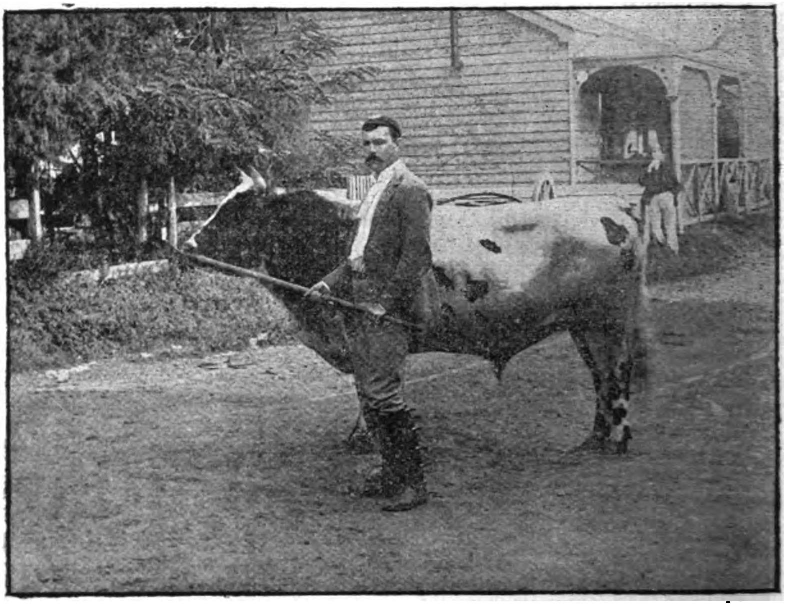


Fig. 2.—Bull "Warrior."

Warrior gained second prize at Blueskin Show as a yearling in a large class, and has been twice first at the Hawkesbury Agricultural Show. He has proven himself an excellent sire, his stock being all that could be desired. He has great robustness of constitution and full of vigour; keeping in excellent condition without any artificial aid on the sour coarse herbage of the common.

Baron Oxhill (imported) is at present the champion bull in New Zealand, having taken champion prizes wherever shown.

A well-known New Zealand judge of Ayrshire cattle, in looking over the heifers 1 and 2 years old sired by Warrior, said that they were a fine lot; and that there was no need to obtain animals from New Zealand or anywhere else to improve them.

In February, 1892, five heifers were purchased privately from Mr. K. B. Ferguson, Waitate Farm, Dunedin, New Zealand. They comprise the following:—

1. Molly, by Young Baron; by Baron II of Drumlanrig, (imported).
2. Mary III, by Carlo; by Baron Oxhill (imported); d Mary II, by Waitati Prince.

3. Snowdrop, by Baron III; by Young Baron.
4. Miss Lewis, by King of the Glen; by Sir Redmond; by Cardigan (imported.)
5. Nora, by Young Baron; by Baron II of Drumlanrig (imported.)

The above all dropped calves within a fortnight of their arrival at the farm to such sires as Ayrshire King (champion at Dunedin for the best Ayrshire bull on the ground this season, although 15 years old.) Ayrshire King was the sire of many champion bulls and cows, among which may be cited Glenham II, and Hover-a-Blink, a prize taker at Melbourne Show, 1892 and 1893, also prizes at Traralgon, Dandenong, Drouin, Buln Buln, and Mornington.

The calves have turned out well, and some of them will soon be coming into use at the dairy.

A further addition was made in January of this year by the selection in New Zealand by Mr. Wright of two heifers of high lineage, purchased and bred by the well-known breeders and importers of Ayrshire cattle, Messrs. A. and J. M'Farlane, of Dunedin. The guaranteed pedigrees, signed by the breeders as correct, are as follow:—

Beauty II; calved, 15th September, 1890; sire, Master Jack, imported; dam, Beauty; Vol. I, N.Z.H.B., No. 67.

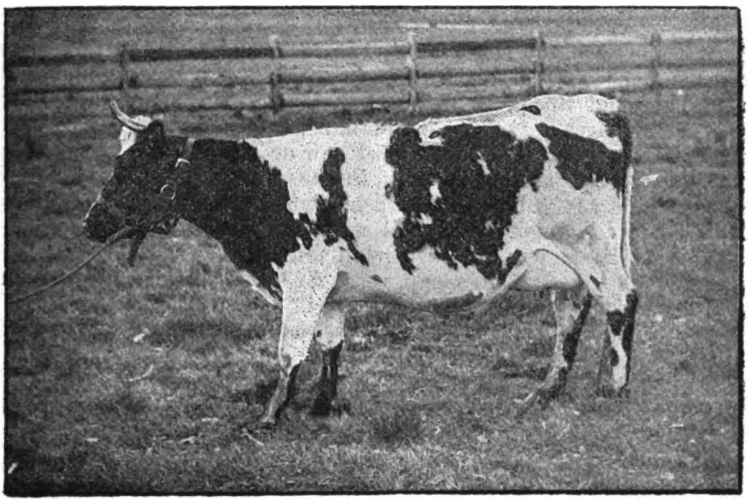


Fig. 3.—"Beauty II."

Master Jack was bred by Mr. John Kewan, Ballewan, Strathblane, Scotland. Sire, Old Master Jack, who won eight first prizes at open shows. Dam, Rose; bred by Mr. Robort Wilson, Renfrewshire, and winner of the following prizes:—Second, at East Killeride, in milk; first, at Withau, in milk; third, at Hamilton, in milk; first, at Shotts, in milk; first, at Bathgate, in milk; second, at Mary Hill, in calf.

Dam of Beauty—Fillpail, Vol. I, N.Z.H.B., No. 60; Fillpail, by Baron II, of Drumlanrig, imported, out of Jeanny by Maori Chief.

Lill II; calved, 20th January, 1891; sire, White Prince, imported by Messrs. A. and J. M'Farlane, of Dunedin; dam, Old Hill.

Sire of Old Hill, Dan, out of Primrose by Sir Redmond; d of Dan' Violet, by Ayrshire Jack, imported; g d, Fancy; g g d, Mary, imported. Old Hill has been a famous prize taker, carrying away first and champion honours upon several occasions.

White Prince, by Prince 47, A.H.B.; d, Fancy I, of Boyside, imported by Messrs. A. and J. M'Farlane. Prince, by White Prince, A.H.B., 6; d, Mary, by Burnhouses, A.H.B., 8; g d, Sprightly, by the Earl; g g d, Badgel, by Dykenook.

Both these heifers have since dropped bull-calves to the renowned Ayrshire imported bull "Marquis of Ailsa," which, if they have any luck, should turn out to be sires second to none in the Australasian Colonies.

The following are the pedigree and particulars of the Ayrshire bull Marquis of Ailsa (the sire of the two bull-calves referred to), bred by Mr. John Holm, of Jaapston, Ayrshire, Scotland, and imported by Messrs. A. and J. M'Farlane, Dunedin, N.Z.:—

Sire Duke of Jaapston, 1914.
Dam Countess 6th, of Drumlanrig, 484, by Minach Drumlanrig, 44.
g d Countess 3rd, of Drumlanrig, 107, by Fleming, of Drumlanrig.
g g d Snowdrop, of Brentwood Hill, 380, by Drumdroch.
Dam of Marquis of Ailsa, Bright Smile, 1307, by Johnnie Faa, 339.
g d 309, b Tarbeg.
g g d Maggie, 282, by Sir William.
g g g d Beauty, by Out-Mains.

Bright Smile won the Derby at Ayr in 1881, and also the first prize for three-year-old cow in milk, and gold medal for the best cow in the yard. Won the Highland Society's medal at Neilston in 1881, and was first at Glasgow as a three-year-old cow in milk; also won Sir Michael Shaw-Stewart's silver cup, value £25, for best cow or quey in the yard. First at Barrhead, as a three-year-old in milk, in the same year. In the following year she was first as aged cow in milk at Ayr; first for best cow entered in the Ayrshire Herd Book; and gold medallist for best cow or quey. At Glasgow, in 1882, she was first as cow in milk, and again carried away the Duke of Montrose's challenge cup, value £25, for best cow or quey in the yard. In 1883 she was first as aged cow in calf at Ayr; first as aged cow at Glasgow, and won the silver cup for best cow or quey. Her g d Maggie, was first for best cow in milk at Ayr, 1862.

Duke of Jaapston's dam, Countess 6th, of Drumlanrig, was first at Sanquhar, and won the Highland Society's medal; and the dam, Countess 3rd, won the Catrine Derby.

The Ayrshire papers, commenting upon the sale of the Marquis of Ailsa, said that no finer bred bull had ever left Ayrshire.

Chemical Notes.

F. B. GUTHRIE,
Departmental Chemist.

Analyses of Cheese.

The following analyses of typical examples of cheese may be of interest to producers. Although the market value of cheese is dependent upon such points as taste, appearance, &c., which are outside the question of its chemical composition, analysis, nevertheless, shows whether it approaches the proper standard of feeding-value, whether the casein and fat (as in cheese made from skim-milk) are in the proper proportions, whether it contains an excessive quantity of water, how much salt has been added, and whether it has been tampered with in any way during the process of manufacture.

A sample of cheese made at Ontario, Canada, which was submitted to the Department as fulfilling the requirements of the export trade, showed the following percentage composition:—

Water	=	34·85	
Fat	=	34·15	
Casein	=	27·31	(calculated from nitrogen.)
Ash	=	3·33	
		99·64	
Ash soluble in water	=	0·88	
Ash insoluble in water ...	=	2·45	
Common salt in soluble ash ...	=	0·77	
Reaction, acid.			
Free acid (calculated as lactic acid)	=	0·30	

This, it will be seen, is a cheese rich in fat, and its chemical composition may well serve as a standard for this class of cheese which it would be desirable to maintain. It is a full-flavoured cheese, and in splendid condition.

It will be interesting to compare a couple of typical cheeses of local manufacture. The first is the product of the Corunna Factory, and was stated by Mr. Olsen, the Danish dairy expert, to be the only New South Wales cheese suitable for the English market. Mr. Olsen's opinion was, no doubt, based upon such outward indications as to flavour, appearance, &c., as cannot be estimated by chemical means. We shall see, nevertheless,

that analysis shows a pretty close agreement in the composition of this and the Canadian cheese above mentioned. The composition of the Corunna cheese was as follows:—

Water	...	30·07	
Fat	...	35·40	
Casein	...	29·94	(from nitrogen.)
Ash	...	3·82	
		99·23	
Ash soluble in water	...	1·29	
Ash insoluble in water	...	2·53	
Common salt in soluble ash	...	1·10	
Re-action, acid.			

It will be seen from the above that this is a somewhat drier cheese than the Canadian. If the water were neglected in each case (that is to say, if both were calculated to dry substance) the similarity in composition would be even closer than it here appears. The amount of acidity in this cheese was not determined. It is, however, very slight. The other sample is a cheese manufactured at Bodalla, and was submitted to the Department as a representative Bodalla cheese. Its composition was as follows:—

Water	...	38·01	
Fat	...	30·44	
Casein	...	27·60	(from nitrogen.)
Ash	...	3·35	
		99·40	

This is a more watery cheese than either of the others, and if it is calculated to dry substances it will be found to be poorer in fat and considerably higher in casein and ash than these.

Night-soil Preparations

Several products obtained by different methods from night-soil have been recently submitted to the Department for its opinion. The analysis of one of these, known as "Pinhoe" manure, was published in a recent number of the *Gazette*. The following may also be of interest as showing the nature of the product obtainable from this source:—

No. 1 is stated to be a mixture of night-soil and urine electrolysed. The exact details are not stated, but it appears to be a modification of Webster's process. The liquid is then said to be mixed with wood-ashes and dried in the sun, the soaking with wood-ashes being repeated three times.

No. 2 is said to consist of excreta only, to which sulphuric acid is added, all liquid having been previously pressed out. The following is the composition of these two products:—

	No. 1. Electrolysed.	No. 2. Treated with acid.
Water	17·13	6·45
*Volatile and organic matter	32·68	34·31
Insoluble (clay, &c.)	14·32	16·48
Lime (CaO)	6·26	14·81
Potash (K_2O)	1·99	1·67
Phosphoric acid (P_2O_5)	1·41	1·93
Equivalent to calcium-phosphate	3·08	4·21
*Containing nitrogen	5·49	1·47
Equal to ammonia	6·66	1·78
Value per ton	£3 15s. 9d.	£1 9s. 6d.

The nitrogen in the first product is remarkably high, owing, no doubt, to the retention of the urine, and if a product of this nature can be obtained

by a reasonably cheap method it should prove a valuable means of disposing of nightsoil. I simply give the numbers obtained by analysis without further comment, as I have no exact information as to the method employed.

Bone-dust.

The following shows the composition of a sample of good bone-dust, manufactured at the Poudrette Works, Botany:—

Water	= 5·79	
Volatile and organic matter ...	= 48·27	(containing nitrogen = 4·87) „ ammonia = 5·91
Insoluble matter	= 3·09	
Tri-calcium phosphate ...	= 34·92	(P_2O_5 = 16·00)
Other lime salts, calculated as carbonate ...	= 7·74	

Mechanical condition.

Fine	= 40·	per cent.
Medium	= 42·5	„
Coarse	= 17·5	„

The value of this manure, if in a fine state of division, would be £4 15s., per ton. There should be no difficulty in producing it in a finer state, as the coarse particles are very brittle. They are, it will be seen, rather in excess in this particular sample.

Poultry.

A Comparative Study of Statistics.

MONSIEUR E. LEMAINE of Crosne (Seine and Oise), a gentleman who has devoted many years of his life to the breeding of poultry, in a commercial point of view, who has been a very successful exhibitor at the Paris Agricultural Show, and whose services to the community at large have been fully recognised, not only by his countrymen, but also by his Government, has written some very able observations on the progressive stages of fowls from their birth up to the period when they lay most eggs, say, three years old. Every wise and discreet merchant, at the end of every year, takes an inventory of his stock and makes out his balance-sheet, which shows his financial position, and it points out in what direction he has been successful, and also where his losses; at the same time it affords him the opportunity of making such modifications which experience has suggested, and this balance-sheet gives him constantly a concise *résumé* of his affairs. It is the same with the poultry breeder and farmer as with the merchant, and, says M. Lemaine, our intention is to lay before our readers an epitome of our weekly publications, thereby avoiding fatiguing references. The accompanying tabulated statement and explanation acquire additional value in view of the success of the trial shipments of poultry and eggs to England. It requires little argument to show that a bird carrying the largest proportion of good meat to bone and offal will be most likely to ensure the highest market price, and the details given are sufficient to enable a breeder to achieve this object with a breed best suited to his local conditions.

"For the last two years we have carefully analysed the many breeds of fowls known in our poultry yards, their differences from, and resemblances to, one another. We have given to each variety a true monography, and we have done all in our power to make this work as complete and instructive as possible. We have thought it would be more interesting to condense these observations, and to present them in a table, so that one might see at a glance the result of our studies and experience. The table we here submit to our readers is composed of thirteen columns. In the first we enumerate the different races of birds. In the second we indicate the soil and climate most suitable. The third is devoted to the development, more or less rapid, that the animal takes according to its breed. The fourth gives the incubative qualities of each race. The fifth, the colour of the chick at its birth. The sixth, the weight of the chick at one day old. The seventh, the increase of weight of the chick during the period of the first twenty days. In the eighth column we give the annual laying of each race. In the ninth, the weight of the egg. In the tenth, the amount of food necessary according to breed. The eleventh, twelfth, and thirteenth are devoted to the quality of the flesh, its average weight at six months, and the average weight of bone.

Race.	Soil—Climate.	Development.	Incubation.	Colour of Chick at its Birth.	Weight of chick 1 day old	Daily increase of the weight of chick during 20 days.	Annual Laying.	Weight of Egg.	Quantity of Food daily.	Flesh.	Average weight of flesh at 3 months.	Average Weight of Bone.
					oz.	oz.	eggs.	oz.	oz.		lb. oz.	oz. dr.
Crèvecœur	Grass, mild climate, fears the fog	Rapid; fattens easily	Does not sit	Black, crest black and white, yellow neck and breast.	1 3/16	3/16	122	2 3/4	7	Exquisite, white, delicate.	4 10	7 15
Houdan	Calcareous, thrives well in all climates.	Very rapid.	Nil	Black and white	1 5/8	11/32	125	2 3/16	6 13/16	Delicate ..	3 15	7 0 3/4
La Bresse (black) ..	Grass, hardy in all climates ..	Rapid; fattens easily	Good sitter; no disposition to steal her nest.	Black, yellow breast.. ..	1 7/16	1/4	160	2 11/16	6 11/16	Exquisite, and fine taste.	3 8	5 4 1/2
La Bresse (grey) ..	In any climate	Rapid; fattens easily	Nil	Grey, brown, black	1 3/16	1/4	150	1 7/8	5 1/2	Very good ..	3 7	5 1 3/4
Barbézieux	Dry, mild climate	Slow ..	Good	Black, yellow breast.. ..	1 13/16	3/16	150	2 7/16	6 13/16	Delicate ..	4 11	8 7 1/2
La Flèche	Dry, mild climate	Slow; fattens easily	Nil	Black, white breast	1 1/2	7/32	140	2 7/16	6 13/16	Very delicate ..	3 6	6 5 1/2
Le Mans	Dry, in all climates	Rapid	Rarely	Black, grey breast	1 13/16	3/16	111	2 1/4	6 11/16	Delicate ..	4 5	7 12
Gournay	Grass, in all climates	Pretty rapid	Rarely	Black and white	1 5/16	3/16	140	2 7/16	4 11/16	Good	2 10	4 9
Courtes-Pattes ..	Hardy breed, dry soil, in all climates.	Middling ..	Good, but late	Black, yellowish white breast	1 1/4	3/16	150	2 3/16	6 13/16	Good	3 10	5 7 1/2
Andalusian	Dry, warm climate	Middling ..	Nil	Grey, slaty light-grey breast	1 5/16	1/8	165	2 7/16	6 13/16	Delicate ..	3 1	5 13
Brahma	Hardy race, dry soil, in all climates	Slow ..	Excellent; good mother	Yellowish white	1 5/8	7/32	120	2 1/4	9 1/2	Pretty good ..	4 11	10 15
Campine (silver-spangled).	Hardy race, requires great space, all climates.	Middling ..	Nil	Black, greyish white ..	1 1/16	3/16	225	1 11/16	5 1/2	Good	2 8	4 3 3/4
Cochin (cinnamon)..	Hardy, in all climates	Very slow..	Excellent; good mother, but heavy.	Yellow	1 13/16	3/16	115	2 1/16	10 1/2	Stringy.. ..	4 9	14 4 1/2
Game	Hardy in all climates	Rapid ..	Capital; good mother..	Brown and black	1 5/16	7/32	100	2 7/32	5 1/2	Excellent ..	3 10	4 6 1/2
Cosaque	Very hardy race, in all climates..	Rapid ..	Nil	Black, yellowish breast ..	1 3/16	1/4	120	2 3/16	4 1/2	Delicate ..	2 15	4 15
Dominique	Hardy, in all climates	Middling ..	Very good, and excellent mother.	Light grey, dark grey ..	1 1/4	7/32	110	2 7/32	4 3/4	Good	3 11	5 5 3/4
Dorking	Grass, mild climate	Very rapid..	Very good, and very good mother.	Dark yellow, brown and white.	1 7/16	11/32	130	1 13/16	6 13/16	Very delicate and juicy.	5 4	7 6 1/2
Spanish	Sandy soil, warm climate, delicate.	Slow; long time feathering	Rare	Black, yellow breast.. ..	1 5/16	7/32	160	2 3/4	6 13/16	Delicate ..	3 1	9 8 1/2
Hamburgh (silver-spangled).	Any soil, all climates	Middling ..	Very rare	Head white, the remainder of the body black and white.	1 3/16	7/32	239	1 11/16	5 1/2	Delicate ..	2 3 1/2	4 6 1/2
Dutch (black) ..	Grass, delicate breed	Middling ..	Nil	Black back, white breast ..	1 1/16	3/16	98	2	5 1/2	Pretty good ..	2 8	4 9
Langshan	Very hardy race, in any climate	Rapid ..	Good; most excellent mother.	Black, breast and neck yellowish white.	1 13/16	3/16	115	2 3/16	7	Excellent ..	5 4	10 10 1/2
Leghorn (golden-spangled).	Very hardy race, in all climates.	Rapid ..	Very rarely	Brown, black, light Havana.	1 1/4	1/4	190	2 7/32	6	Indifferent ..	3 15	7 0 3/4
Polands (silver-spangled).	Delicate race, fears the damp ..	Not very rapid.	Rare	Light grey, dark grey ..	1 3/16	3/16	100	2 1/16	4	Delicate ..	2 13	4 12
Scotch Grey	Grass, delicate race	Middling ..	Nil	Light grey, dark grey ..	1 1/4	7/32	110	2 7/32	6 13/16	Good	3 4 1/2	4 15
Bantam (silver-spangled)	Very delicate breed, dry soil ..	Middling ..	Pretty good	Grey, light grey, and white.	9/16	..	80	1 1/8	2 1/2	....	..	..
Game Bantam ..	Delicate breed, dry soil	Middling ..	Good; must not be disturbed.	Black, brown, light Havana..	7/16	..	90	1 3/32	2 3/4	....	..	..
Nagasaki	Sandy soil	Middling ..	Indifferent	Light grey, yellowish white..	1/2	..	95	1 4/32	3 1/2	Good	..	..
Silkies	Very hardy race, in all climates..	Rapid ..	Excellent; very good mother	Silky down, straw yellow, very light	1/2	..	98	1 1/2	3 9/16	Very bad, horrible	..	..
Australian Game ..	Very hardy, in all climates ..	Rapid ..	Good; excellent mother	Brown and black	..	..	100	2 1/4	*	Excellent ..	..	..
Wyandottes (golds and silvers).	Hardy, on well-drained soil ..	Rapid ..	Capital; good mother..	Brown, black, light grey, dark grey.	..	..	110	2 1/4	†	Good	..	..
Plymouth Rock ..	Hardy, on well-drained soil ..	Rapid ..	Good; fair mother ..	Black and white	..	..	110	2 1/4	*	Good	..	..
Minorca	Hardy, dry, warm climate ..	Rapid ..	Rare	Black, with a little white (vary considerably).	..	..	200	2 1/4	*	Good	..	..
Orpington	Hardy, in all climates	Middling ..	Middling	Black, white breast	..	..	115	2 1/4	*	Good	..	..

* Large feeder. † Moderate

"A single glance at the table will indicate better than all the explanations the practical interest it shows. The breeder or farmer who does not leave to chance the future of his poultry-yard can, if he consults this memento, make his choice of the poultry most suitable to the soil he cultivates, and which is likely to prove the most profitable, whether for egg-producing or for the table. Should any be undecided about the choice of a breed, let him look first at the nature of the land, whether it is dry, damp, calcareous, sandy, or grass land; then he may consult the above table, and make his choice accordingly. Certain breeds of fowls cannot live in a damp, foggy atmosphere; others, on the contrary, can live in all climates, and a remarkable fact that fowls native of torrid zones are more hardy than birds native of temperate zones.

"This table, prepared after long study and close observation, is useful in many ways. It shows even in the chick as soon as hatched to which breed it belongs; it also gives the daily increase in weight during the period of the first twenty days. It shows the produce in eggs in each race, it gives the weight of the different eggs, also the average weight of flesh at six months old, as also the weight of bone, and on this account the table ought to be carefully studied. Supposing one would wish to know which breed produces most flesh, on consulting the table one would notice the Langshan as being the heaviest; but with its 5 lb. 4 oz. of flesh, there are 10 oz. 10¼ drachms of bone, whereas the Dorking, 5 lb. 3½ oz., has only 7 oz. 6¼ drachms of bone. All these elements are to be taken into consideration by the breeder and farmer."

A few breeds have been added to the table, commencing with the Australian Game, with a view to making it more useful in this country, although there are at present no data to entirely fill the different columns.

Practical Vegetable Growing.

Directions for the Month of January.

Attention cannot be too frequently directed to the value of surface cultivation of the soil, particularly during the dry hot months of summer. There seems to be an impression amongst many of those who cultivate the soil, that the harder the surface is allowed to remain, the less danger there is of evaporation taking place, and gardens may be seen almost everywhere having the soil as hard almost as stone. The idea of not cultivating the surface is most erroneous, and all those who are adopting the suggestions offered in these gardening notes are strongly urged to keep the hoe or cultivator at work as frequently as they can. It may not be out of place to mention that orchardists should keep a cultivator continuously at work, day after day during the summer, weather permitting. There should be no room for weeds in either vegetable garden, orchard, or farm. Weeds are not wanted; but judging from the appearance of the majority of orchards in this Colony, the owners seem to favour their growth. Constant cultivation will do away with weeds altogether, will invigorate the plants, and will prevent the evaporation of moisture from the soil. A heavy mulch of farmyard manure will prevent evaporation and serve as useful plant-food as well, and when dug into the soil after it has served its purpose as a mulch will prove valuable, not only as a plant-food, but, during its process of rotting, will perform important work in making the soil better adapted for plant growth.

Many of our soils are deficient in vegetable matter, a defect which it is most important should be remedied. On the farm where large areas are cultivated, this can be best done by ploughing in green crops; but in the home vegetable garden the droppings of domestic animals will have much the same effect.

During the month of January the application of liquid manure will be found to be of considerable value to growing vegetables. It may be pointed out that the crisper and more tender the vegetables, the more valuable they are for use, so that the quicker they are grown the better, and the less chance there is that they will run to seed, which is only too frequently the case with such plants as cabbage and lettuce. The liquid manure need not be made very strong, and it is not likely that this will be the case if it is made from the droppings of animals. If, however, it is prepared from "artificial manures," such as sulphate of ammonia, superphosphate, or from specially prepared concentrated manures, considerable caution must be used. Again if the urine of animals is collected and allowed to ferment, it becomes very strong, and will need to be considerably diluted with water. This latter manure is exceedingly valuable, and should always be collected where possible from stables, &c.

Any seeds that may be sown now should be carefully looked after, watered, and shaded. If just sown and left to themselves they will probably perish. Seedlings that may be planted out will need care and attention until they become firmly established. The plants should be watered thoroughly before they are taken up, and watered again after they are planted, and if necessary the watering should be continued for a few days.

It will not be necessary to plant out much at a time if a succession of planting is carried on, therefore although it may appear that all the care suggested amounts to a great deal of work, in point of fact there is but little trouble in it. Half a dozen cabbages a week need take but a very few minutes to plant with the greatest care, and even to prepare and manure the land for, but in the course of a year these will make a total of upwards of 300. And so on with other vegetables. The great secret of success in vegetable-growing is never to allow any part of the garden to remain idle, and then a surprisingly small portion of ground will be sufficient to supply the family with all the vegetables they can consume. How it is that all those who live in the country and have any spare ground about their houses, and a very little spare time, do not grow all the vegetables they need is a puzzle. Perhaps these notes and suggestions may prove useful to those who know little or nothing about vegetable-growing, but if anything else should be required, the readers are invited to write to the Department of Agriculture for any information they may need.

Bean, French or Kidney.—This vegetable may be sown as largely as may be required. The best plan to adopt is to sow a row or two once a week, or perhaps it would be better to sow a row, wait until the plants have come up, then sow another row, and so on. The ground should be well dug before sowing, and if it is not naturally sufficiently rich, it should be heavily manured with well-rotted farm-yard manure. It may be as well to state that if chemical or artificial manures are used, sulphate of ammonia, nitrate of soda, or manures known as nitrogen or ammoniacal manures, are of little if any use for French beans. Lime, gypsum, potash, or sulphate of lime are the best substances to apply, but it is hardly possible to do better than apply plenty of well-rotted stable or farm-yard manure for any vegetables whatever. This is always safe, and, as a rule, most effective.

Cauliflower.—This month is a good time to plant out cauliflowers from the seed-bed. In the first place, prepare some ground by trenching if possible, or deep digging, and thoroughly well manuring, mixing in the manure well. If the soil is dug or trenched deep the roots of the cauliflowers will descend to a considerable depth in search of food, and will not suffer from dry weather. Select good strong sturdy plants and set them about 3 feet apart each way. Do not break or injure the roots more than can be avoided when raising the plants from the seed-bed. Sow a little seed in a seed-bed or box where it can be shaded or watered easily.

Cabbage.—Sow a little seed and shade and water. Put out a few young plants in well-manured and well-prepared ground.

Celery.—A little seed may be sown, and a few plants put out in well-manured or rich ground. This vegetable will need to be well watered and also treated to occasional supplies of liquid manure.

Carrot.—Sow a little seed in drills, taking care to separate the seeds well before they are sown. Thin out any young plants that may be coming on, and be careful to keep them free from weeds.

Lettuce.—Instead of planting out from the seed-bed it will be better, at this season of the year, to sow in rows in a richly prepared bed in the garden

and thin out the plants to about 9 inches apart when they come up. If lettuces are transplanted just now they are very apt to run to seed.

Peas.—In the coolest parts of the Colony a few rows may be sown.

Potatoes.—Prepare a bed for planting by deep digging, well draining, and heavily manuring. When ready, plant some variety of the kidney potato. Use medium-sized whole tubers, for they will probably succeed better than large ones cut into two or more pieces. The rows should be from 2 ft. 6 in. to 3 feet apart.

Red-beet.—Sow a row or two of this useful salad vegetable on some ground that had been previously heavily manured for cabbage, potato, or some other crop. The seed will probably take a long time to come up, especially if the ground is dry. If it be thoroughly soaked in water before it is sown and the drills in which it is also well watered it will come up much sooner.

Tomatoes.—In most gardens there should be good supplies of ripe fruit. Some means should be adopted to keep the branches or vines from lying on the ground and thus rotting the fruit. They are awkward plants to tie up if allowed to attain full growth before the tying up is attempted. The work should be done as they grow. Bundles of sticks, prunings of fruit-trees, or dead branches of trees can be spread under the plants, and this will answer in a rough way to serve the purpose. If required, young plants may be put out to keep up a succession of fruit.

The month of January is generally considered to be an "off" month for vegetables, and there is often a scarcity if the weather prove to be dry; but, with a little care and trouble, if a good supply of water is available, quite sufficient may be raised for all requirements.

If onions are ready for lifting care should be taken to do the work without bruising them, and after they are raised do not, on any account, leave them in the sun to dry, or else they will not keep for any time.

The Flower-garden.

As, no doubt, anyone who takes the trouble to grow his own vegetables is almost certain to grow a few flowering plants, it may not be out of place to give a few hints for the guidance of those new to the work. It would be well to mark with strong, short stakes the places where bulbs are growing, for they are now casting their leaves, and probably their places will be forgotten and the bulbs injured. If desired, the bulbs may be taken up and stored away in a dry, airy shed or outbuilding until required later on for planting. But there is no necessity, really, to raise the bulbs unless to divide them. Many roses will cast their leaves about this time of year, especially if the weather is dry. They may be pruned back, just as if it were winter or early spring, and the plants will produce good flowers in the autumn. Many of the tea-scented varieties of roses will probably bloom well. They are the most useful class for small gardens. The best flowering plants for the summer and autumn months are the Bouvardias, of which there are many beautiful varieties. Chrysanthemums will need good supplies of water, and also weak liquid manure. The plants had better be well mulched with farm-yard manure. Dahlia plants should be tied up to stakes as they grow, and they will need plentiful supplies of water and liquid manure. Small plants like cowslips, daisies, or polyanthus, if allowed to remain in the garden fully exposed to the hot sun, will be very likely to die. They had better be watered, and removed to a cool, shady place for the remainder of the summer, and can be replanted in their old situations in the winter or early spring.

Orchard Notes for January.

All over New South Wales the month of January is a very busy one for fruit-growers, the principal work of the month being the gathering and marketing of the fruit, which will consist largely of apples, pears, plums, passion-fruit, peaches, nectarines, figs, grapes.

Apricots and cherries, except in the latest districts, will have been finished in December.

During the month there are sure to be one or more gluts of fruit. On this account too great care cannot be taken to so pick, grade, and pack the fruit that it shall show to the best advantage, as, even in a glutted market, really good fruit, well shown, always sells well. There is sure to be a great surplus of second-rate fruit, and this will continue year by year until our fruit-growers learn by experience that more money can be made by growing only a few varieties of each kind of fruit—and those of the best kinds—than by growing every variety that they can possibly crowd into their orchards. A great deal of this second-rate fruit is very hard to dispose of, as it is valueless to the canner or drier, and will not even make a good jam. Its only value is as fresh fruit, and for this purpose there are many fruits very much superior to it, that are also valuable for canning, or, when evaporated, form a saleable article. Although the gathering and marketing of the fruit will take up the most of the orchardist's time, the cultivation of the ground should not be neglected, especially in the drier districts of the Colony, where, owing to the sun heat, it is absolutely necessary to keep the soil of the orchard in as fine a tilth as possible, so as to minimise the loss of water from the surface by evaporation. Where means are available for irrigation in the dry districts, a watering should be given during the month to the later varieties of fruits, care being taken to cultivate the land that is irrigated as soon as a horse can be got on to it without packing the soil. If this is done no further irrigation will be necessary, as the water will be retained in the soil so as to meet the trees' requirements. During the month there is not likely to be much occasion for spraying, except grass-hoppers, crickets, or locusts appear and defoliate the trees, when the use of Paris green is a very effectual remedy. Codlin moth will also have to be fought all through the month by means of bandages, which should be removed every week, and all the larvæ found in them destroyed. All cases that have held wormy fruit should also be dipped in boiling water, so as to destroy the larvæ or pupæ of the moth that may be in hiding in the crevices. This is of especial value in districts that are now free from the moth, as the great means of bringing the disease to these districts are the old cases that are returned to the orchardists, and that have been used to carry wormy fruits. During this month it is advisable, in the case of cherry orchards, to do all the heavy pruning that is required—that is to say, all broken branches should be removed, and if there are too many main limbs that are crowding the tree

they should also be cut out now, as the cherry is less likely to bleed (gum) soon after the crop is gathered than at any other time of the year. If a big limb has to be removed, always trim the edges of the cut with a sharp knife, and cover the wound with either grafting-wax, rubber paint, or shellac varnish, made as recommended in the *Gazette.**

The nursery will require constant attention during the month, thorough cultivation will be necessary to keep down all weeds, and to keep the soil in fine tilth. Budding can be continued all through the month, but care must be taken to have the stocks in good working order, as unless the bark will run freely there is very little chance of having a good take. Should the bark not run then it will be advisable to give the stocks a good irrigating, which will soon bring them right. Choose good plump buds off healthy trees, and in budding always tie tightly up to the shoulder of the bud. Examine the ties carefully and cut them as soon as the bud has united with the stock, as if neglected, the tie will often ruin the trees, especially in the case of the strong growing stocks.

* Vol III, p. 673.

General Notes.

Seed Maize.

There is a somewhat general belief that seed taken from the centre of cobs give better results than from the ends. In order to test this, the Principal of the Hawkesbury Agricultural College instituted a series of experiments, and gives his results in the following terms:—"I have been carrying on sundry experiments with the object of proving that seed taken from the base of a cob give as good results as that taken from the centre. Last year, seed taken from the centre of a cob yielded 45 bushels 18 lb., while that taken from the end of the cob yielded 49 bushels 49 lb. Experiments conducted in America have given similar results, and at Ohio Station the average yield per acre for fourteen years was, butt 66·9, middle 62·8, tip 64·8. I am of opinion that so long as the seed is well grown and fertilised it makes no difference whether it is taken from the butt, centre or tip; and I consider that it is simply a fallacy, and as absurd in its application as a principle as it would be to insist that the first and last born of a family were superior to those children forming the intermediate and connecting links of that family. Only one year's experiments is not sufficient to prove a matter of this kind, and we are consequently continuing these experiments this year, and shall no doubt reach the same conclusion they have obtained in the United States of America, where the growing of corn and maize form so considerable a part of their agriculture."

Circular *re* Noxious Weeds.

Those correspondents of the Department who, in reply to the above circular, promised to send flowering or fruiting specimens of the most noxious weeds, as they appeared, are reminded that at the present time a large number of weeds are in proper condition for botanical examination.

AGRICULTURAL SOCIETIES SHOWS, 1895.

Society.	Secretary.	Date.
Dapto A. and H. Society	... A.B.Chippindale	January 8, 9
Albion Park A. and H. Society	... T. Armstrong ..	„ 16, 17
Kiama Agricultural Association	... J. Somerville ..	„ 24, 25
Moruya A. and P. Society	... J. Kay	„ 29, 30
Lismore A. and H. Society...	... G. T. Hindmarsh	„ 30, 31
Wollongong A. and H. Association	... J. A. Beatson ...	„ 30, 31
Berry A. and H. Society	... A. J. Colley ...	Feb. 5, 6, 7
Alstonville A. and H. Society	... H. R. Elvery ...	„ 7, 8
Bega A. and P. Society	... A. J. Wilson ...	„ 12, 13
Ulladulla (Milton) A. Association...	... C. A. Cork ...	„ 19, 20
Uralla P. and A. Association	... J. D. Leeco ...	„ 19, 20
Candelo A. Association	... C. H. Brooks ...	„ 19, 20
Berrigan A. and H. Society	... R. D. Drummond	„ 20
Lithgow A., H., and P. Society	... M. Asher ...	„ 21, 22
Nepean District (Penrith) A., H., and I. Society	... R. Benaud ...	„ 21, 22
Armidale A. and P. Association	... W. H. Allingham	„ 26, 27
Tumut A. and P. Association	... W. A. Bridle ...	„ 26, 27
Robertson A. Society	... R. J. Ferguson..	„ 27, Mar. 1
Camden A. and H. Society...	... W. R. Cowper ..	„ 26, 27, 28
Namoi (Narrabri) P., A., and H. Association ...	... J. Riddle ...	March 5, 6, 7
Tenterfield P. and A. Society	... J. Harker ...	„ 5, 6, 7
Taralga A. and P. Association	... J. J. Walsh ...	„ 6, 7
Macleay A., H., and I. Association	... H. R. Gray ...	„ 6, 7, 8
Berrima District (Moss Vale) A. and H. Society	... J. Yeo	„ 7, 8, 9
Walcha P. and A. Association	... H. Chapman ...	„ 13, 14
Cootamundra A., P., H., and I. Association ...	... T. Williams ...	„ 13, 14
*Inverell P. and A. Association	... J. M'Ilveen ...	„ 14, 15
Glen Innes P., A., and M. Association	.. J. Denshire ...	„ 20, 21
Gundagai P., A., H., and I. Association... ...	... W. E. Kyle ...	„ 20, 21
Crookwell A. and P. Association	... H. J. Peard ...	„ 22, 23
Cooma P. and A. Association	... W. Madgwick ...	April 3, 4
Royal Agricultural Society of New South Wales	... F. Webster ...	„ 10 to 16
Castle Hill A. and H. Association	... F. H. G. Rogers	„ 15, 16
Warialda P. and A. Association	... W. B. Geddes...	„ 24, 25
Mudgee A. Society	... J. M. Cox ...	„ 25, 26
Hunter River A. and H. Association	... W. C. Quinton..	May 1, 2, 3, 4
Coonamble P. and A. Association...	... F. R. Salt ...	„ 8, 9
Gwydir P. and A. Association (Moree)	... J. G. Cohen ...	„ 8, 9

* District National Prizes to be offered.

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[2 plates.]

THE

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OF

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CONTENTS.

NOTICE OF COPYRIGHT.

Stinkwort

(*Inula graveolens*, Desf.)

A Pernicious Weed, which will obtain a firm hold in this Colony unless our Farmers take serious steps to eradicate it.

By J. H. MAIDEN,
Consulting Botanist.

Botanical name.—*Inula*, a Latin classical name for Elecampane, and, perhaps, a contraction of the word *Helenium*, which was applied to the same species. By mediæval writers it was written *Enula* (Bentley and Trimen). *Graveolens*, the Latin word for strong-smelling.

Botanical description.—This will be found by persons interested in the botany of the plant, at page 468, of Vol. V., of De Candolle's *Prodromus*. It is there described as a hairy-viscid, very branched, small shrub; the lower leaves being oblong-lanceolate and sub-deentate, while the upper leaves are linear and entire.

Is Stinkwort of any value as a forage plant?—We must answer this question in the negative. It is quite true that cattle will nibble it with their other pasture, and may also be attracted to the plant itself and eat it moderately when other feed is available to them, but, as a very general rule, stock of all kinds avoid it, and so, unless it is pulled up or ploughed up, it matures and produces a plentiful crop of feathery seeds. Cows should be carefully kept from it, and also animals intended for food, as the flesh of animals fed on it will be coarse, strong-tasted, and bitter, while the milk, butter, and cheese will be spoiled.

Stinkwort is now thoroughly well known. It has been a terrible pest in South Australia for many years, and the agricultural literature of that colony contains abundant references to it. The *Garden and Field*, and the *Journal of the Bureau of Agriculture*, of the southern colony have, in particular, taken notice of this very bad weed, and I have made some references to these very valuable publications.

Following is an account of an attempt to render Stinkwort more palatable to stock, but an unsuccessful one, and I think that it is the feeling of most people that it is hardly a matter for regret that this bad-smelling plant does not often tempt the appetite of our domestic herbivorous animals.

A Mr. Royston Roberts, in the *Garden and Field* for May, 1890, gives an account of his method of making Stinkwort ensilage, or rather Stinkwort hay, in layers with salt between the layers. He says, "Like ensilage, horses require a few days to get used to it, and afterwards they seem to prefer

A

it to the best hay. Cattle eat it greedily. If given to cows in milk it gives the butter a slightly bitter taste. I regard it as one of the best of our summer fodder-plants, and if ploughed in early before it seeds, it makes excellent green manure."

Mr. Roberts' example was followed by Charles Rake and Sons, Enfield, S.A., and they report (*Garden and Field*, June, 1890), that after leaving the Stinkwort in the silo for six weeks, they placed it before some hungry young stock, but, beyond licking off the salt, the silage remained untouched by the animals.

Some uses for Stinkwort.—It is said that every plant has its use, if we can only find out that use, and no doubt there is a large amount of truth in this homely saying. At present, as regards Stinkwort, its only practical use of importance is that of green manure, but then only as an adjunct to eradication of the pest, for its manurial value is not very high.

In this connection the following notes are of interest:—The *Garden and Field* (January, 1891) says, "We hear of several persons who can trace a considerable and distinct increase in the yield of cereal crops through the enrichment of the soil by this weed when treated as a green manure."

Nearly four years later it was reported (*Garden and Field*, December, 1894) that one of the few crops of wheat in the Lyndoch (S.A.) district resulted from the ploughing in of coarse green Stinkwort, which kept the land open and drained it. On the other hand (January, 1895), a Mr. Stewart reported that on 2 acres of land he ploughed the Stinkwort under and he only got a return of 10 bushels to the acre, while he got a return of 30 bushels when he hoed the weed up and burnt it, the seasons being much alike as regards rainfall.

We must await further information in regard to its value as a manure, although I am not hopeful that it will prove to be of much value, as I have already stated.

In the 1894 report, page 60, of the celebrated firm of Merck, of Darmstadt, we find "*Extractum Inulæ graveolentis spir. spiss.*" In other words, alcoholic extract of Stinkwort. It is prepared from the leaves, freed from essential oil. The report goes on to say:—"It was known to the Ancient Greeks, and has long been used for colic, dysuria, and amenorrhœa. In Australia it has been used as an anti-asthmatic. The plant, or rather the extract obtained from it, has lately become more interesting, as M. Mendelsohn (*Deutsch. med. Wochenschr.*, 1894, No. 30) produced with it paralysis of respiration and the locomotor apparatus in animals of various species. Closer investigations proved that in symptoms of paralysis two different substances are concerned, of which one convulses the front extremities, whilst the other produces paralysis of the hind extremities, which latter eventually predominates in the general effect. These results of investigations might lead to practical application of the remedy."

But do not let these investigations incline the farmer to look upon Stinkwort with a more tender eye, for even if a very large demand (which is exceedingly unlikely) were to spring up for this drug, it could be readily satisfied from its native home on the shores of the Mediterranean.

In the *Garden and Field* for July, 1894, it was pointed out that in Europe the dried plant is used for smoking bacon and hams. One gentleman in South Australia tried the experiment, and reported it to be a success.

Elecampane (*Inula Helenium*) is a very close and well-known relation of the Stinkwort.

A decoction of the root of the Elecampane was said by Dr. Withering many years ago to have cured sheep affected by scab. Elecampane was at one time largely used in medicine, but now its use is chiefly restricted to veterinary medicine.

How to get rid of it.—In discussing methods of eradication of Stinkwort (*Garden and Field*, April, 1894), it was agreed that vigorous measures should be used by everyone who had an interest in keeping the land clear, as those who had no experience of Stinkwort did not realise the immense loss which would accrue through allowing it to get beyond control. One gentleman intended to plough it under before it flowered. Another speaker thought such a course would be very dangerous, as ploughing would not destroy it,—indeed, stirring the land, he was afraid, would only increase its vigour. He was hoeing it, and found it effectual, although it might require several years hoeing to thoroughly eradicate it. He believed that hoeing before the plant flowered, as well as pulling up, which was better still, though more troublesome, was the only effective means of dealing with the pest.

This advice is clear and specific enough. Where it has once seeded it will not be got rid of in a year, and its eradication means more hard work for the farmer who has quite enough work to do already. See page 308 of the May *Gazette*.

Where found.—Countries round the Mediterranean Sea, from which it has spread to many warm countries.

Stinkwort has already made its appearance in New South Wales.—The pest has already got a footing in south-western New South Wales, as could have been confidently predicted. I do hope that our farmers will be able to cope with it, as it has been one of the most costly weed-pests to the South Australian farmer.

In April, 1889, I reported as follows to the Agricultural Society of New South Wales in regard to Stinkwort, specimens of which had been sent over from the Royal Agricultural Society of South Australia:—"To none of my correspondents nor myself is the plant known as having been introduced into New South Wales, though that is only a matter of time, probably short. Specimens of an *Inula* (I cannot trace the specimens now, J. H. M.) were sent to Sydney last year from southern New South Wales, suspected of doing injury to stock. Except by analogy, nothing is known of its properties here, but I do not for a moment believe that it is poisonous, although such a rank-growing weed, so full of fibre, would be highly indigestible, and the bitter would probably be very palatable to stock, especially to horses. The hyaline sticky resin is probably an interesting substance, common to many composites, but I do not think European chemists have worked at it, while Australian ones certainly have not. Species of *Erigeron* (cobbler's pegs) are almost as great a curse in parts of New South Wales as this species of *Inula* appears to be in South Australia, and no practicable plan appears to be known for the eradication of either."

In the *Herald* of 28th March, 1890, is the following telegram from Albury. It refers to Stinkwort:—"A noxious weed new to this district has bee found in the paddocks near Burrumbuttock. It is said to be identical with the weed common in South Australia. It begins to grow in the summer months, has a straight stem, and grows (according to the nature of the soil), from 3 inches or 4 inches to 3 feet and 4 feet high. It is of a nice green colour, has small yellow flowers, and a very strong and nasty smell. It spoils all grazing land, especially for dairy cattle. The milk becomes green,

with a very offensive smell, and the butter, after about two days, will give an unbearable smell."

Mr. G. S. Mackay, Secretary of the Albury Pastures and Stock Board, writes to the Department under date of 15th March, 1894, "Stinkwort has only lately made its appearance." In the *Gazette* of May, 1895, page 308, Mr. Odewahn, of Walla Walla, near Albury, reports it (the word *Inula* is spealt *Mula* through a typographical error).

Reference to Plate.—1. Lower leaf, oblong-lanceolate and sub-dentate. 2. Upper leaf, entire and nearly linear. 3. Portion of flowering twig. 4. Flower-head, passing into fruit. 5. Receptacle, showing concave depressions and radiating bracts. 6. Seed with pappus. Our specimen was received from Mr. A. Molineux, F.L.S., General Secretary of the Bureau of Agriculture, Adelaide. It was not a very good specimen, but the best available at the time of year.

Inula graveolens, Desf.

(11650-95-6)

"Stinkwort."

The Weeds of New South Wales.

Supplementary Notes. No. 1.

By J. H. MAIDEN,
Consulting Botanist.

[Note.—It has occurred to me that it would simplify reference a good deal if, since many of the weeds of New South Wales have been already referred to in my articles on the subject in the *Gazettes* for the months of March, April, and May last, any subsequent notes on weeds were similarly classified under Natural Orders. In course of time we shall, in this way, have a convenient weed-record for the Colony.]

MALVACEÆ.

Paddy's Lucerne (*Sida rhombifolia*, Linn.; Syn. *S. retusa*, Linn.)

[Previous references, *Agricultural Gazette*, 1894, page 537; 1895, page 229.*]

"Believed to have been introduced here by a clergyman now out west thirty-three years ago. All over this district; stock occasionally nibble at it, and stunt the growth, but on account of the quantity of seed each fruit contains, it is almost impossible to eradicate it." (Forester Brown, Port Macquarie.)

ZYGOPHYLLEÆ.

Calthrops (*Tribulus terrestris*, Linn.)

Mr. Forester Hardiman, of Narrandera, writes:—"I forward you a specimen of a thorny creeping plant, which bears a small yellow flower, and which was first noticed in this district about three years ago. It takes possession where it appears, destroying all other herbage, and spreads rapidly. It withers in frosty weather, and is pernicious to the horse, for when the thorn enters the hoof it completely rots the frog, thus crippling the animal. A gentleman here thought this creeper so pretty that he planted it in his garden, with the result that it was destroying all his other flowers, and he has now much difficulty to eradicate it."

This plant is *Tribulus terrestris*, a native of the Colony; sometimes it is called "Calthrops," because of those spiked instruments which ancient nations used to throw on the field of battle in order to lame the horses. It should be hoed out before it fruits.

LEGUMINOSÆ.

African Acacia (*Cassia lævigata*, Willd.)

[Previous reference, 1895, 232.]

By the way, this isn't African, and it isn't an Acacia; but this is as good a name as many of our plants get. It is sometimes known as "Laburnum."

* In subsequent references, to save space, the year of publication of the *Gazette* and the page will only be quoted.

"It likes good soil, and takes possession of good land in patches. Isolated plants are met with miles apart, but always on rich soil near a brush; proving that it is slowly spreading. If brushed it quickly grows again. It is very tough to break, seeds abundantly, and is not touched by stock. It is difficult to get rid of when established." (Forester Brown, Port Macquarie.)

ROSACEÆ.

RASPBERRY BUSH (*Rubus rosæfolius*, Sm.)

"This indigenous plant grows luxuriantly on good soil, on the roadsides through brushland, and in paddocks where the timber has been felled and left. Fruit eaten in bush; also made into pies and jam." (Forester Brown, Port Macquarie.)

A BURR (*Acaena sanguisorbæ*, Vahl.)

[Previous references, 1891, 709; 1895, 233.]

Mr. A. H. Belfield, of Eversleigh, Dumaresq, reports that this weed has made great headway in parts of New England during the last few wet seasons. In that district the squatters do not fear the burr much, as far as the wool is concerned, as the sheep ought all to be shorn before the burrs are ripe, but it is covering valuable grass-land.

PASSIFLOREÆ.

NATIVE PASSION VINE (*Passiflora Herbertiana*, Lindl.)

"Grows quickly amongst felled timber, partly burned off; also in neglected cultivation and grazing paddocks, and edges of brushes. Likes good soil. Fruit and leaves are said to poison stock* in a few days; they seem fond of it. No steps are taken here to eradicate any weeds growing in cultivation. When ploughing-time comes round, everything is ploughed in." (Forester Brown, Port Macquarie.)

COMPOSITÆ.

BLACK THISTLE (*Carduus lanceolatus*, Linn.)

[Previous reference, 1895, 233.]

"Grows readily on ringbarked land. Stock sometimes nibble at the heart of it, carefully crushing it before chewing. It is said to die out in about three years; it will not grow in forest-land. Known to be growing here since about 1884." (Forester Brown, Port Macquarie.)

COCKSPUR (*Centaurea melitensis*, Linn.)

[Previous references, 1891, 31, 141, 179; 1895, 140.]

"Called 'Larkspur.' Very bitter, and spoils the butter when eaten by cows." (Mr. Denis Murray, Gunning.)

STAR THISTLE (*Centaurea calcetrapa*, Linn.)

[Previous references, 1891, 41, 178, 181; 1894, 468; 1895, 235.]

"Called 'Chinese Thistle.' Eaten by cattle." (Mr. Denis Murray, Gunning.)

ST. BARNABY'S THISTLE (*Centaurea solstitialis*, Linn.)

[Previous reference, 1891, 179.]

"Not noticed to have been eaten by stock; very bitter." (Mr. Denis Murray, Gunning.)

* They may cause gastric disturbance, but I believe that they are not poisonous.

BATHURST BURR (*Xanthium spinosum*, Linn.)

[Previous references (illustrated article), 1895, 446; also 236.]

The following interesting account of the Bathurst Burr, from the pen of Mr. Charles Ledger, of Cinchona and Alpaca fame, supplements the illustrated article already alluded to:—"I have been reading an account (in the *Goulburn Herald*) as to supposed poisonous qualities of the Bathurst Burr (see page 445 of July *Gazette*). This weed, called in South America 'Cepa-caballo,' was brought from Chili about 1835, *i.e.*, the seed was brought in the tails and manes of the mares and horses imported by Mr. Benjamin Boyd from that country. Indeed, I well remember seeing in July, 1836, two vessels with over 1,000 horses and mares leave Valparaiso for Twofold Bay; the barbarous manner in which the poor animals were shipped I cannot forget. At that time I was one of the boys on board the barque 'Swallow,' working my passage out to Peru. The owner of the 'Swallow' was A. E. Robson, Esq., who, with his nephew, Mr. Geo. Smith, and a Senor Don José Sandés were the founders at Iquique of the present gigantic nitrate of soda industry. In all the interior of South America the 'Cepa-caballo' (Bathurst Burr) is esteemed for its medicinal properties—as a blood purifier it is highly esteemed in decoctions. The macerated leaves, as a poultice applied warm, have great healing attributes. I write this from practical experience on several occasions. I have seen sheep and cattle eating it, but it is in no case a "fodder," nor is it generally eaten by horses or cattle. I have seen the leaves cooked and eaten as salad medicinally. As it abounds in South America, it got mixed in the lucerne hay on which the horses and mares were fed during the voyage from Chili. Mr. Boyd imported over 3,000 mares and horses (so I have heard), and in 1853, when on the Maneroo (Monaro) Plains, I saw several animals with well-known Chili brands."

I suppose Mr. Ledger's account is really that of the first introduction of the "Bathurst Burr" into this country. It has for so many years been common in Mediterranean countries, that I have no doubt that its seeds have been brought thence to Australia also.

Mr. Forester Brown, of Port Macquarie, reports:—"Said to have been introduced in the manes and tails of horses from India many years ago. Likes rich soil. Very isolated, and few here. It seems to take possession of any small patch of loose, good soil. The best means of destroying it is to uproot it and to see that the burrs are all burnt. The seeds, after being covered about 10 inches with soil on Murrumbidgee flats for several years, when ploughed up, germinated."

With reference to the supposed medicinal properties of the "Bathurst Burr," to which Mr. Ledger alludes, Bentley, "Manual of Botany," 4th edition, page 583, says of it:—"The powdered leaves of this plant are said to be a most efficient remedy in hydrophobia, but they have been found useless when employed by regular practitioners."

In the United States this weed is known as "Chinese Thistle," and its burrs cause great destruction to the wool, as with us. It is stated to be probably the one meant in the Oregon weed law as "Dagger Cockle Burr." In Oregon the botanist of the Oregon Experiment Station speaks hopefully:—"It is not likely to become very troublesome, as it lives but one year, and is easily killed by cutting off the top. Keep the plants from maturing seed by frequent mowing, or clean cultivation with a hoed crop, and you will soon be rid of it."

A Burr (*Calotis cuneifolia*, R. Br.)

[Previous reference, 1895, 238.]

"This burr is very troublesome to the feet of dogs in the summer weather. The burr-plant in the summer withers to a dust, and leaves the burrs all over the surface of the ground; they are almost invisible. Travellers are much annoyed by this burr getting into their blankets; also it is very bad for wool." (P. Corbett, Dolo Tank, Wilcannia.)

Bastard Cobblers' Pegs (*Erigeron linifolius*, Willd.)

[Previous references, 1891, 708; 1895, 238.]

"Grows on poor cultivation land after the crops are off. Seeds abundantly carried by the wind. Of no use. Has been in the district for twenty years. Easily killed." (Forester Brown, Port Macquarie.)

Black Cobblers' Pegs (*Vittadinia australis*, A. Rich.)

[Previous references, 1891, 178, 180; 1895, 238.]

Called "Tommy Hardy," or "Salt-water Weed," at Tintenbar.

"Has only become a pest within the last four years, when it spread all over the district during a very wet season, and has kept on spreading. The light seeds are carried by the wind like thistle seed. It is not touched by stock, grows on all grazing land, and is very rank on unused enclosed land." (Forester Brown, Port Macquarie.)

Stinking Roger (*Tagetes glandulifera*, Schrank.)

[Previous references, 1891, 707; 1895, 239.]

"Takes possession of any cultivated land, particularly amongst corn, and grows up to 8 feet high. The juice or seed getting into the eyes makes them smart very much, similar to a spark getting into the eye, or like sandy blight; the effects last 3 or 4 days, and men working amongst it with bare arms are marked the same as freckles by it, smarting painfully for a day or two, and the spots peeling off. The weed is spreading everywhere, and a field of it can be smelt half a mile off." (Forester Brown, Port Macquarie.)

The flowers of this plant are used in the Argentine as a stomachic, aperient, diuretic, and diaphoretic, and are also employed in cases of gastritis and indigestion. Their application is, however, said to be attended with danger. O. Hesse (*Annalen*, 276, 87; and *Journ. Chem. Soc.* LXIV, 623 (1893), has made a chemical investigation of the flowers.

Dumb Nettle (*Galinsoga parviflora*, Cav.)

[Previous references, 1891, 94; 1895, 238.]

"Likes newly turned up patches in vegetable gardens; easily killed; not much here." (Forester Brown, Port Macquarie.)

Wild Dandelion (*Hypochaeris radicata*, Linn.)

[Previous reference, 1895, 240.]

"Spreads very fast in grazing paddocks, crowding out a lot of grass, increasing very much. Not known when introduced." (Forester Brown, Port Macquarie.)

Stinkwort (*Inula graveolens*, Desf.)

See illustrated article at page 667.

Poor Man's Friend (*Bidens pilosa*, Linn.)

[Previous reference, 1891, 708.]

"So called, because if touched by clothing, sticks to it (an amusing *non sequitur*, J.H.M.), thus easily distributed; also sticking to legs and tails of stock; prefers cultivated land; established about 15 years." (Forester Brown, Port Macquarie.)

CAMPANULACEÆ.

Garden Weed (*Lobelia purpurascens*, R. Br.)

[Previous reference, 1894, 473.]

"A great nuisance in well tilled land, vegetable or flower garden. It shoots up from 1 or 2 inches under the surface, and spreads rapidly." (Forester Brown, Port Macquarie.)

ASCLEPIADEÆ.

Cotton Bush (*Gomphocarpus fruticosus*, R. Br.)

[Previous references, 1894, 7; 1895, 291.]

"Likes good soil, in cultivation paddocks, and where the grass is high; not much here." (Forester Brown, Port Macquarie.)

SOLANACEÆ.

Stramonium (*Datura Stramonium*, Linn.)

[Previous reference, 1895, 292.]

"Very fond of rich soil on flats, or where rubbish is deposited. Over 20 years in the district, but has not become a nuisance yet." (Forester Brown, Port Macquarie.)

Native Tobacco (*Nicotiana suaveolens*, Lehm.)

[Previous reference, 1895, 293.]

Mr. T. T. W. Mackay, Inspector of Stock, Wanaaring, writes:—"The tobacco plant (dwarf) I am quite positive will kill sheep, cattle, and horses, but it depends greatly on the quantity they consume, more so with cattle and horses. I inspected three horses that had eaten this plant (were seen to do so). These horses were worked daily, and fed on oats and chaff, as there was no grass, but were allowed to go about at night and for a short time in the middle of the day. On this occasion the horses were turned out as usual in the middle of the day, and before the horses were fed, they were allowed to have a feed of this plant, the owners thinking that this plant was good herbage, with the result that a good many were sick, and three of the horses were so bad that the teamsters had to leave them behind, with a man to look after them. Fortunately the horses had not eaten a sufficient quantity to kill, but even with what they had eaten I believe the horses would have died, if they had not been looked after; one horse was so bad that they had to put him in slings for a time.

"In the case of the cattle that died at Conulpie Downs, my informant is Mr. W. Bell, of Conulpie Downs, and Mr. Bartlett, owner of Carreapendy Station. I have seen the carcases of the forty head which died on stock route on Conulpie Downs. The drover in charge of said cattle came to Conulpie Downs for rations, and the storekeeper asked him where he left his cattle. He replied, "Oh, out on that patch of herbage." On learning

this, the storekeeper told the drover to gallop back as fast as possible and remove his stock, which he did; but when the cattle moved out of camp next morning, the drover found forty head dead on the camp. In that year, 1892, there was a very bad drought, and not a vestige of grass anywhere in that locality. The only thing the stock had to exist on was "Mulga," and very little of that. There is no doubt that stock will not touch this tobacco plant if there is anything else to eat. Yet, the fact still remains, that in droughts (and strange to say this plant seems to grow thicker and more luxuriantly in dry seasons), stock will eat it; that it will kill, and if a sufficient quantity is eaten, *will kill in a few hours.* How much it takes to kill an animal, I cannot say, but I should say quite a small quantity. From the evidence of all the stock-owners, managers, overseers, station hands, &c., in the country, where this plant grows, they have no hesitation in pronouncing this plant as poisonous,—and they one and all give the places where it grows a wide berth." (Mr. T. T. W. Mackay, Stock Inspector, Wanaaring.)

WILD TOBACCO TREE (*Solanum verbascifolium*, Linn.: var.: *auriculatum.*)

"Favours land which has been cleared and not cultivated, and fairly good soil. Is spreading, but is easily kept in check. It grows up to about 8 feet generally; is an abundant seeder, and distributed by birds; stock like a few leaves; has been about twenty years in the district." (Forester Brown, Port Macquarie.)

ORANGEMAN, OR BROAD-LEAF NIGHTSHADE, &c. (*Nicandra physaloides*, Gærtn.)

"Grows amongst corn all about here; in certain localities it is very rank. It does not appear to injure the crop. Some farmers state from experience, that if ploughed in when about 2 feet high, it improves the land amazingly, equal to manuring." (Forester Brown, Port Macquarie.)

ORANGE-FLOWERED CESTRUM (*Cestrum aurantiacum*, Lindl.)

It is reported that cattle have died from eating this orange-flowered garden shrub near Sydney.

VERBENACEÆ.

LANTANA (*Lantana Camara*, Linn.)

[Previous references, 1891, 288; 1892, 330; 1895, 294.]

"In some rare cases when clearing, the old bushes have been pulled up with a chain round the trunk by a team of bullocks, but the seeds are carried all over the district by birds, particularly the Black Magpies. It establishes itself in any land not used, and, but for the birds would spread very little. Supposed to have been introduced here about fifty years ago by one of the first settlers. Lake Innes is the home of it." (Forester Brown, Port Macquarie.)

BLUE WEED (*Verbena bonariensis*, Linn.)

[Previous references, 1891, 30, 288, 633; 1895, 295.]

"Eaten sometimes by stock when it is young, also after being cut down and half dry, grows in good soil about the edges of cultivation paddocks, and on flats where flood debris has been left. Not difficult to eradicate." (Forester Brown, Port Macquarie.)

POLYGONEÆ.

DOCK (*Rumex pulcher*, Linn.)

[Previous references, 1891, 177; 1895, 298.]

"Grows in cultivated land. Very difficult to get rid of, the tap root striking down to 2 feet or more; also grows in grazing land if not much used. Seeds distributed by stock, as it clings to their legs and tails. Has been in district over twenty years." (Forester Brown, Port Macquarie.) It is not generally known that this is an indigenous species, but it is spreading nevertheless.

LABIATÆ.

SHIVERING WEED (*Stachys arvensis*, Linn.)

[Previous references, 1890, 307; 1894, 82; 1895, 299.]

"Most frequently seen about the edges of lucerne paddocks, sometimes in vegetable gardens, very little in this district. Said to give horses the shivers if overheated when driven. Cattle not effected by it. Introduced here in lucerne seed and hay." (Forester Brown, Port Macquarie.)

SCARLET SALVIA (*Salvia splendens*.)

"This ornamental garden plant has escaped from cultivation, and grows, on the Richmond and Tweed, in dense masses on many road-sides. It is spreading everywhere."

AMARANTACEÆ.

SILVER WEED (*Alternanthera dentata*, R. Br.)

"Spreads very quickly on grazing land if moist, and apparently choking out the grass. Very little here." (Forester Brown, Port Macquarie.)

PHYTOLACCACEÆ.

PARRAMATTA OR DYE-BERRY (*Phytolacca octandra*, Linn.)

[Previous reference, 1895, 300.]

"Takes up newly-felled and burnt country; useless. Not difficult to exterminate but for the black magpies, which are very fond of it, and distribute the seeds. Each patch of old bushes dies out in a few years. Known in the district for twenty or twenty-two years." (Forester Brown, Port Macquarie.)

CHENOPODIACEÆ.

NETTLE-LEAVED GOOSEFOOT (*Chenopodium murale*, Linn.)

[Previous reference, 1895, 301.]

"I send you specimen of a weed that appears to be spreading in this district; more noticeable in cultivated land under irrigation. No stock will eat it." (Mr. John Mathews, Howlong Station, Carrathool.)

The plant is *Chenopodium murale*, a native of England and other parts of Europe. It is a member of the saltbush family (*Chenopodiaceæ*), and, while it is useless as a fodder, it possesses no poisonous properties. It has probably been spread in dirty seed, and it should be carefully hoed out before it seeds. Unfortunately, it has been introduced into Australia for many years, and has obtained a firm hold.

IRIDEÆ.

(*Sisyrinchium micranthum*, Cav.)

Supposed to be poisonous to stock, both on the Upper Manning and on the Richmond River. A very small, grass-like plant, with minute yellow and black flowers. Very common in damp gardens and other moist places.

JUNCEÆ.

Tussock or Reedy Grass (*Juncus communis*, E. Mey.)

"Takes possession of cultivated land, which has been used for grazing a few years, and in a flat moist position. The only way to eradicate it is by hoeing or ploughing up, stacking in heaps, and burning. Spreads very quickly in paddocks. Has been in the district many years." (Forester Brown, Port Macquarie.)

CYPERACEÆ.

Nut Grass (*Cyperus rotundus*, Linn.)

[Previous references, 1891, 30, 703; 1895, 302.]

"Supposed to have been introduced about fifteen years ago. [Far longer than this.—J.H.M.] Most difficult to eradicate, the nut or root from which it springs being 10 or 12 inches below the surface. Digging does not get rid of it altogether. The only case I heard of getting rid of it was on the Macleay River, where a man fenced part of it in, and turned pigs on the land, who rooted it all up, and eat the nuts. It seems to prefer cultivated land; also grows on pastures. No steps taken to thoroughly eradicate." (Forester Brown, Port Macquarie.)

Poverty Grass (*Cyperus Gunnii*, Hk.)

"Grows readily, spreading quickly in grazing land. Impossible to get rid of. Stock eat it, but get very poor on it. First noticed about five years ago as increasing to an alarming extent." (Forester Brown, Port Macquarie.) A native plant.

Botanical Notes.

By J. H. MAIDEN,
Consulting Botanist.

Mr. Charles Ledger, of Cinchona and Alpaca Fame.

It is not generally known that we have still amongst us (at Kenmore, near Goulburn) Mr. Charles Ledger, famous in two hemispheres for the introduction into Java, after most perilous adventures, of the most valuable variety of any species of cinchona. To the last generation of Australians his name was very familiar as the introducer of alpacas and other animals into New South Wales, only accomplished, like his previous venture, after much vicissitude and actual peril.

It falls to the lot of very few men, either in Australia or out of it, to have been the means of doing so much good to their fellowmen as Mr. Ledger has been able to effect by his introduction of *Cinchona calisaya*, var. *Ledgeriana*. The old gentleman is still hale and hearty, and it occurred to me that this journal would be a particularly appropriate medium by which to remind our raisers of "new products" in New South Wales of the cinchona enterprise, which, although forty years old, should be fresh in the memories of the present generation. Mr. Ledger is one of the most retiring of men, and the notes to me were not intended for publication, although when I recently asked permission to publish part of them in the *Gazette*, Mr. Ledger allowed me to do so.

As regards the cinchona, Messrs. Howard and Sons, the great quinine firm, write to Mr. Ledger quite recently:—"It is not too much to say that it is entirely owing to the seed received from you that Java is now supplying the world with quinine. Some of the cultivated Bolivian bark is of quality equal to the Java bark from your seed, but it seems that the cost of cultivation is much greater than in Java."

To which Mr. Ledger remarks, in a note to me:—"The expenses of cultivation are not greater in Bolivia. It is the distance from port of shipment that causes greater extra expense than in Java. From where cut, the bark is carried on the backs of Indians out of the Monte at least 20 to 100 miles, then from 300 to 1,200 miles on donkeys or llamas to La Paz (city of 60,000 inhabitants); there it is put up in packets of 150 lb. net of bark, covered with half a bullock hide (no return allowed for hide when sold), and carriage to Tacna by mules, 285 miles, then 40 miles by rail for shipment at Arica. Export duty in my time, or up to 1853, 20 dollars per quintal of 100 lb."

Messrs. Howard and Sons again write:—"There is certainly no doubt of the importance to the Dutch plantations in Java of the seed supplied by you

in 1865. Almost the entire supply of bark from Java is sold as *Ledgeriana*, and comes from that supply. The only complaint that they could make would be that it has turned out so rich that they are supplying too much for the world to consume. *Succirubra* from India and Ceylon is rapidly becoming a thing of the past. English Government plantations apparently fail to propagate your seed to more than a very small extent, and a great deal of *Ledgeriana*, which is grown in Ceylon, is from Java seed. It is difficult to give exact figures, but the quantity of bark from your seed now produced per year, cannot be far short of 10,000,000 lb."

Truly a benefactor to suffering humanity—the man who has made it possible for quinine to be brought within the means of the very poorest.

Although infinitely less important to the world than the cinchona venture, Mr. Ledger's alpaca expedition has rendered him better known to Australians, and the story of the alpacas is familiar to people who lived in Sydney thirty or forty years ago.

In the year 1858 Mr. Ledger introduced into the Colony a flock of llamas, alpacas, and vicunas, but the breeding of them did not prove so profitable to our squatters as it was hoped it would be.

Even at the present day an account of the veteran's adventures with the alpacas, &c., is full of interest from beginning to end. One account is given in a series of four papers in the *Sydney Magazine of Science and Art*, Vol. 2 (1858–9), pages 151, 182, 190, 221, entitled "An Account of the Llama and Alpaca, with Notes of a journey from the Bolivian and Argentine Provinces into Chili with a flock of these animals."

Attention may also be drawn to Mr. Ledger's letter, dated 15th October, 1861, and published at page 75 of the Catalogue of the Natural and Industrial Products of New South Wales, shown at the London Exhibition of 1862. Mr. Ledger there gives some notes in regard to his experiences with the alpacas and llamas in this Colony.

What I have written is a mere reminder of the work of a distinguished citizen of New South Wales (and the world is too apt to forget those who have done good service). Those of my readers of the rising generation who desire to make themselves familiar with the adventures of Ledger and his devoted servant, Manuel Incra Mamani, who died from the effects of the cruel treatment to which he was subjected because of the assistance he gave in procuring the cinchona seeds, will probably find that their local medical man will readily show them how to procure the information.

Sassafras Timber in the Bega District (*Doryphora Sassafras*, Endl.)

Mr. Forester Benson, of Bega, writes:—"I forward a sample of the sassafras found growing at Myrtle Creek, situated in the parish of Wyndham, county of Auckland.

"The trees are not abundant, but I noticed several over 100 feet in height, and 3 feet in diameter. The timber is very useful for indoor work. I was shown a large house on the creek, where all the rooms are lined with it, and it seems to be equally as well adapted for that purpose as pine. The window frames and some of the furniture are of mountain hickory, which appears to be a valuable timber for cabinet-making. I was informed that sassafras should be cut in the winter and stacked for some months, as it is liable to warp; also that it is free from the attacks of white ants."

BEECH—"WHITE BEECH" (*Gmelina Leichhardtii*).

THE following additional notes from foresters (supplied in response to a circular from the Department) supplement the Consulting Botanist's article on the subject in the *Gazette* for May, page 288:—

"Never plentiful in my district; only a few trees left in very rough places." (Forester Martin, Gosford.)

"With the exception of one or two saplings only, I have not seen any of it in this district." (Forester Rudder, Booral.)

"In the Comboyne shrub, and in brushes under it, from Thone Creek to the heads of the Camden Haven and Stewart's Rivers, embracing parts of the parishes of Innes, Wallibree, Lorne, Lansdowne, Yarratt, Marsh, Kerewong, and Comboyne, an average of one per acre; average contents, 500 feet; over an area of 100,000 acres. Also at heads of Pappinbarra Creek and Kindee Creek, parishes of Albert and Kindee; average, one in 20 acres; average, 1,000 feet; over an area of 2,000 acres." (Forester Brown, Port Macquarie.)

"This timber is comparatively very scarce in my district, and it does not (in any portion of the same) exist in any quantity. The areas occupied, localities, and approximate quantity would be very difficult to arrive at. I may say it is very sparsely distributed throughout the brush portions of my district, with the exception of the Dorrigo and other table-lands therein; on the latter I have not yet observed the white beech. Large quantities have been removed from this district years ago, particularly from the Allgomera Forests and the Upper Nambucca River, but not much remains in easily accessible places sufficiently matured for use. Probably from 20,000 to 40,000 feet might be readily obtained (if required, at an advanced price). Like red cedar, it is becoming very scarce, and only to be obtained in very rough places following creeks and gullies." (Forester MacDonald, Kempsey.)

"White beech is very scarce in this district, and only now to be found on small areas in some of the outlying localities, and 50,000 feet would, I think, cover the amount of this timber in this district." (Forester Huxham, Grafton.)

"There is only a very small quantity of the white beech (*Gmelina Leichhardtii*) growing in this district. A few trees are to be found on reserves 4,353 and 10,723, county Rous; 14,150, county Buller; 1,120, counties Rous and Buller; on Crown lands, Haysback; and watershed, between Koreela and Beaury Creeks, county Buller." (Forester Crowley, Casino.)

"Very little of the timber is available in my immediate locality, it having been in earlier days much sought after by timber-dealers." (G. M. M'Keown, Wollongbar.)

"White beech is found in more or less quantities throughout all the brush-land in this district, and I estimate that the brush-land occupies one-third of the whole area of the district, the residue being forest land, on which beech is never found. As regards the quantity, I estimate that one tree to 2 acres is a correct computation. There is an abundance of beech in the Terania Creek reserve No. 249, also in the Macpherson Range reserve 4,353, and the eastern end of Tweed River forest reserve 250. I believe the average quantity of timber per tree would be 2,000 superficial feet." (Forester Pope, Burringbar.)

ADDITIONAL NOTES ON COLONIAL OR MORETON BAY PINE (*Araucaria Cunninghamii*, Ait.)

THE following notes, referring to the occurrence of this pine in three foresters' districts, supplement the account of the tree which was given in the *Gazette* for June, page 379 :—

"This timber is to be found both on reserves and Crown lands on the eastern falls, but not in large quantities except on forest reserve No. 1,608, county of Gresham, where it is fairly plentiful and in all stages of growth, The largest tree on said reserve that I know of is 9 feet 3 inches girth and about 50 feet high. At present there appears no great demand for it, and I think I will be over the mark when I estimate the yearly demand at 40,000 superficial feet." (Mr. E. J. Deverell, Forester, Glen Innes.)

"This pine is growing in great quantities on the reserves in this district. I would estimate the area of reserves upon which pine is growing to be about 190,000 acres, and out of that 110,000 acres to be thickly covered with matured pine, about eight (8) trees to the acre. Besides this there are two large areas of Crown lands in the counties of Drake and Buller, recommended by me for reservation, about 100,000 acres, containing large patches of pine. There are also several good patches on Crown lands not reserved. There are large quantities of pine cut here, most of which is sold to the mills on the river; the balance is shipped to Sydney." (Mr. W. F. Crowley, Forester, Casino.)

"Colonial pine is well distributed throughout all the reserves on the Tweed and Richmond Rivers, on an average of four trees to the acre. Its chief use here is for the linings of houses, though it serves this purpose indifferently owing to the ravages of white ants, which attack it immediately, and completely riddle it in three or four years. Its durability is very greatly influenced by the time of the year in which it is cut—more so in this timber than in many others, though of the highest importance to all. I have frequently seen borers in it a fortnight after felling if felled when the sap is up; whereas if cut when the sap is down, I have noticed it untouched by them after lying twelve months. The only purpose for which colonial pine may be used with advantage to any extent is in the manufacture of packing cases. It will not stand exposure, nor last in the ground. The ruling price on these rivers at present is 2s. 9d. per 100 superficial feet." (Mr. W. P. Pope, Forester, Burringbar.)

The Cause of Gumming in Sugar-cane.

By N. A. COBB.

In August, 1893, I inoculated a number of stools of cane at Harwood, Clarence River, N.S.W., with the microbe called in my report on the diseases of sugar-cane* *Bacillus vascularum*. Those inoculations were made in order to find out whether or not this microbe is the cause of gumming. As a result of hundreds of careful examinations, I was able to say that the disease gumming, as described in that report, never occurred without the yellow gummy matter in the sap-vessels.

The result of even a much greater number of examinations made with equal care showed that the yellow gummy matter never occurred without the microbes, indeed it was very evident that the gum was a product of the growth of the microbes. This led to the conclusion that the disease never occurred without the microbes being present, and it may be added that many cases were examined in which, in spite of long and careful search, none but the merest traces of other foreign organisms could be found. This was very strong evidence that the microbes are the cause of the disease, but it did not amount to proof. We may indeed say that if the injurious results of the disease follow solely from the plugging up of the sap-vessels, then the injury is due primarily to the *Bacillus vascularum*, but after all this is only a qualified statement.

The Inoculations.

In order to show whether the disease is caused by the microbes, healthy plants were inoculated with gummy matter from diseased cane. I found it to be unnecessary to first make pure cultures in the way usually adopted, for the reason that a pure growth of microbes could be obtained without this precaution. Plenty of cane could be found containing no other organism in its interior tissues, and advantage was taken of this fact in making inoculations.

The method adopted will be of interest to students of plant diseases. The inoculations were performed with needles. These were prepared as follows:—A steel needle an inch long, mounted in a wooden pen-holder, was ground down on an oilstone until its diameter near the point measured one two-hundredth of an inch, and near the hilt one one-hundredth of an inch. The point was then converted, by grinding, into an exceedingly fine chisel or wedge. The position of this wedge, which was of course invisible to the naked eye, was indicated by trimming the opposite end of the wooden pen-

* "Plant Diseases and their Remedies:—Diseases of the Sugar-cane," Sydney, Charles Potter, Government Printer, 1893.

holder into a similar shape, and making its edge parallel to that of the invisible steel chisel. A second needle similarly mounted was ground down to about half the size of the first; its point was not in any way altered.

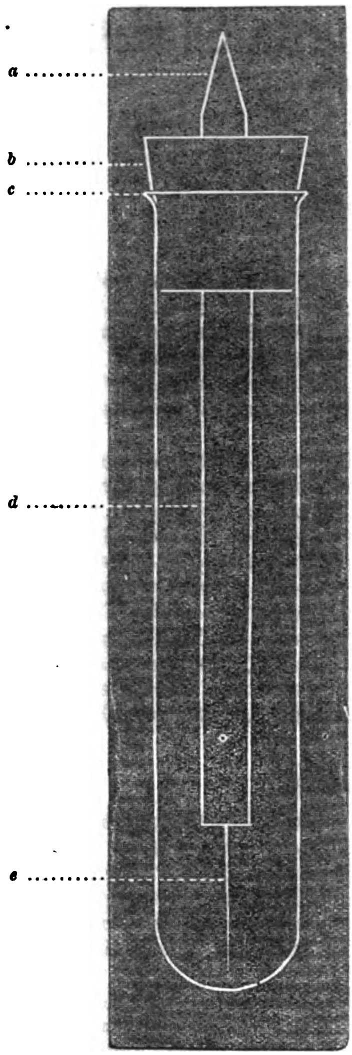


Fig. 1.—Diagram to show method of mounting and sterilising inoculating-needle; *a*, wedge-shaped or chisel-shaped end of wooden pen-holder; *b*, cork; *c*, top of test-tube; *d*, wooden pen-holder; *e*, needle whose point is ground to correspond in shape and position with *a*, the top of the pen-holder.

It was reasoned, if the first needle was thrust into a stalk of healthy cane with its chisel-edge parallel to the fibres, that should it, as was very probable, strike a sap-vessel, the vessel would be split open with a minimum of injury, and if, when this needle was withdrawn, the second and smaller needle, bearing the virus, were thrust into the same hole that an inoculation would be accomplished. If this method were surrounded with the necessary precautions against foreign organisms it seemed as though it ought to answer.

The precautions alluded to were provided as follows:—The needles were mounted in test tubes as shown here (Fig. 1), and sterilised, tube and all, by heating in an oven for several hours at about 300° Fahr. A large glass-stoppered bottle was smeared inside with glycerine, and allowed to stand overnight. The rind was removed from a piece of selected gummed cane, and the end was trimmed well, and it was then placed in the glass-stoppered bottle. Just previously to being placed in the bottle its end was retrimmed with a sharp knife that had lain for several hours in an oven heated to about 300° Fahr., not less. These operations were performed in a room as free from draught and floating dust as possible. It was argued that if the microbes were the only organisms in the selected piece of cane, then a needle could be prepared for inoculation purposes by simply dipping its point in the gum that oozed out while it stood in the bottle. Most careful observations were made both before the cane was selected and after the inoculations were over, to make sure that no other organisms were present.

When inoculating, the surface of the cane to be inoculated was first smeared with hot wax from a wick, the flame of which had been extinguished less than a second before. As chance would have it, the inoculations were made during weather when little or no dust was floating in the air, namely, after heavy rain. The inoculating needles were taken to the field in their tubes. The chisel-edged needle was inserted through the smear of wax into the cane for a distance of half an inch or more and withdrawn, to be immediately followed by the second finer needle bearing the microbes. The hole was then immediately covered with more hot wax, and the plants marked for further reference.

Investigators of plant diseases have been looking with interest for the results of this method of inoculation. Here they are.

Six inoculations were made, one a check—that is, pricked with a sterilized needle only. The stools were in charge of Mr. C. N. Stevens, Manager of the Colonial Sugar Refining Company's mill at Harwood. At the time of inoculation all the stools appeared to be healthy.

The canes were forwarded to me at Sydney in September, 1894, and examined with the following result:—

1. Mr. Stevens reported the check lost.
2. Of the inoculated canes, four were still alive, the other was dead.

All the four living canes were gummed—one slightly, but very manifestly; two very markedly; the fourth dying, and evidently from gum, though fungi had made their appearance.

The gumming was most marked in the neighbourhood of the point of inoculation and above it, though it appeared throughout the culm.

Concerning the dead and dying canes, Mr. Stevens writes:—"The dead canes have probably some time or other been broken off or shaken at the root, which would account for their demise." The fact that one of the still living stalks, as reported above, was dying, and to all appearance from gumming, would suggest that death may have been caused by gumming. It is impossible to say, however, from the dead and dying canes in their present dry condition, what was the cause of death. The canes were in five different stools. Mr. Stevens writes:—"All the canes in those stools are now more or less gummed." The question arises, "Would these five canes have become diseased if they had not been inoculated?" As stated above, they appeared at the time of inoculation to be perfectly healthy, and this, of course, was the reason why they were chosen for the experiment. This fact—their apparent healthiness—is in favour of their remaining healthy. The gumming in the canes forwarded to me was most marked near the point of inoculation and above it. This fact is in favour of the disease originating from the inoculation. As reported below, canes were also inoculated with a fungus. In the same stool two stalks were inoculated with microbes. In the case of this stool the two stalks inoculated with the fungus showed no trace of gumming, though they were examined minutely. Although Mr. Stevens says "all the canes in these stools are now more or less gummed," his remark could not apply to this particular stool, as all, or nearly all, the stalks in it were inoculated and were sent to me. This fact is again strongly in favour of the gumming which appeared in this stool having originated from the inoculation.

Against these facts and deductions must be set the fact that a large part of the cane on the Lower Clarence, where these experiments were made, suffers from gumming. I think it may fairly be said that the canes taken

for experiment were not very liable to become gummed, as they were in good garden soil not before under cane, and had good care and were derived from what were supposed to be sound crops.

Conclusions.

These experiments point to the microbe *Bacillus vascularum* as the cause of gumming. The course of the disease when resulting from the introduction of a few microbes into well-grown tissue of the stalk is slow, and need not end fatally in less than one year. The method of inoculation is a success.

II.—The Cause of Cane Spume.

At the time of the above inoculations, two stalks were inoculated with the spume fungus, *Trichosphaeria sacchari* of Massee (*Strumella sacchari*, Cooke). The method has been already described.* The result was not a striking one until the canes were cut into pieces. Externally the canes showed the characteristic signs of the disease as described in the report on cane diseases; the canes, however, were still alive, and were such as would have been cut and sent to mill. Internally, however, affairs were seen to be in a bad way. Here again the disease was worst near the point of inoculation, and above it; in fact, the canes were "piped" in the whole of the upper part, the cavity being large, in most places half an inch across. Here the diseased tissue was brown or red; the remaining tissue, though still white, was becoming dry and less sweet. I should have remarked that the external appearance of the disease was confined to the side of the stalk inoculated, showing that the sickness tends to travel longitudinally in the tissues, and as before mentioned by me in my report on this disease.

The canes experimented on were thrifty 1-year olds. On younger plants this fungus acts more energetically.

Remedies and Preventives.

Here I can only repeat my advice of last season, calling attention to a few additional words concerning the burning of trash.

1. *Sets.*—First in rank among the measures to be taken against gumming is care in the selection of sets. All other precautions will be in vain if gummed sets are planted. "Anything is good enough for seed"—that is one of the banes of potato-growing. I fear that it has not been without its pernicious effect on cane plantations. "No sugar-boiler will buy that piece there,—better cut it for plant-cane." Has the cane-farmer ever been guilty of this thought? Let him answer for himself. In some cases I fear his crops answer it but too plainly for him.

In treating of this matter last year I showed conclusively the evils resulting from planting gummed sets. My arguments were drawn from observations on the crops and experiments of farmers, but were none the less reliable on that account. Most conclusive of all, the presence of microbes in the tissues of the eyes of gummed sets was demonstrated. To enforce this I selected sets gummed in various degrees—slightly, badly, and very badly—and these were planted, with the inevitable result, namely, the resulting canes were

* Plant Diseases and their Remedies.—Diseases of the Sugar Cane. Sydney: Charles Potter, Government Printer, 1893.

gummed in proportion to the gum in the sets. This experiment was tried also by a number of others, always with the same result. Through the kindness of Mr. Knox, general manager of the Colonial Sugar Refining Company, I am able to publish the following illustration, taken from a photograph forwarded to him from the Richmond River.

Fig 2.—Three stools of cane, grown from selected sets. The stool on the left grown from a healthy set, that on the right from a badly-gummed set, while that in the centre grew from a moderately-gummed set. This figure is accurately reproduced from a photograph. The stools grew side by side as shown, and were of the same age.

Sound sets are easily procured. Any cane-farmer can easily qualify himself to select them. Let him simply familiarise himself with the appearance of healthy cane, and then use no other for plant-cane. Of course selected sets will cost more labour or more money; but both will be wisely spent, and will be returned manifold at harvest time.

To select sets free from gumming proceed as follows:—Select a clean place and use a sharp knife (as sharp as a razor), and cut the cane into sets. Cut the stalks into two-eyed sets from the top downward, and endeavour to cut nearer to the joint of the set further away from the hand. I make this recommendation because the shock of cutting shatters the cane on the side away from the cutter, as can easily be seen on examining some cuttings. This shattering injures the resulting sets less if the cut is made as here directed. The inspection will be much easier and more thorough if the stalk is given a half turn with the left hand after each cut; both ends of a set can then be inspected easily, as both will face up at the same time. As the sets are cut they should be stacked in long piles with the cut surfaces facing upwards. After half an hour or so, or more if in the shade, the sets may be inspected, and any gummed sets easily spotted and picked out. The inspection will be unsatisfactory unless the cuts are clean, and it will be found almost useless to attempt this operation with anything but a thin specially-sharpened knife. By following this method any farmer who has a fairly good crop may get sets fairly free from gum. I am inclined to think, however, that cane-farmers will find it more to their advantage to encourage a competent person to make a specialty of furnishing cane for plants. There

are from 700 to 1,000 tons of seed-cane required annually on the Lower Clarence. If a plant-cane specialist had access to all the farms on the river, and had the privilege of buying at the market rate—that is, the sugar-mill rate—he could afford to put a good deal of time into selecting healthy cane for plants, and make a good living out of the business at from 25s. to 30s. per ton, providing, of course, he received the patronage of the majority of the farmers. A man, to make a success of this business, would have to be a good judge of cane and its diseases, and possess the confidence of the farmers, and at the same time have business ability. He should have control of a launch and several punts, and a gang or two of cutters. At planting time his capacity would be taxed to its uttermost; at other seasons he should be on the look-out for fields from which to secure his plants for the coming season. Very likely this business could be combined with some other to advantage.

2. *Drainage.*—Good drainage decreases the loss due to gumming as well as those due to other diseases. The drainage on many of the farms on the Lower Clarence is not so good as it ought to be.

3. *Burning the Trash.*—When land is kept continuously under cane it is highly desirable to thoroughly burn the trash after each cutting. This destroys a vast number of germs—not only those of gumming, but of many other diseases, as well as the eggs and grubs of destructive insects. This is the common practice in the Australian cane districts, and to it no doubt they owe their comparative freedom from disease. Where crops are quite free from disease it is of course safe and profitable to plough in the trash as manure, but as soon as any considerable amount of disease appears trash-burning should begin.

4. Land itself contains many of the germs of disease—that is to say, after the crop has stood on it for a length of time. Consequently, if one crop is followed by another of a different sort not subject to the same diseases, there will be less loss from disease than where land is left continually under the same crop. Whether this rotation of crops is advisable depends on the markets that are available. In the absence of rotation, a bare fallow once every few years does much good, both in renewing the strength of the soil and allowing diseases to run out.

5. *Seedlings.*—Where a crop is derived from cuttings from a previous crop, and not from seed, unless great care is used there is a gradual decadence in the quality of the crop; the variety runs out, as the saying is. This running out of varieties is much more noticeable in crops like cane and potatoes than in that of crops derived from seed.

Of late years considerable attention has been given to producing new varieties of cane by raising seedlings. Though the sugar-cane as it grows in New South Wales produces, when allowed, a great quantity of seed-flowers, it produces very little fertile seed, so that considerable trouble has to be taken to produce a seedling. That it can be done, however, was shown by Mr. M. H. Samson, of the Colonial Sugar Company, who has produced one such seedling. It was a thrifty-looking plant, which seemed unusually robust, as is usual with seedling cane. It seems probable that varieties that have run out may be renewed or improved by raising seedlings from them. This is a line of experiment that is within the power of any cane-farmer, and one which is promising enough to be worthy of attention.

It is difficult to tell young seedling canes from grass-seedlings. On this account I would recommend that the seeds of cane be first sown in boxes of carefully baked soil. The baking will kill all grass-seed and other seed contained in the soil, so that whatever comes up after sowing cane-seed on

such soil may be set down at once as cane. The seed should be sown on the surface, or be but slightly covered, and the soil should be kept moist and shady.

6. *Improving by Selection.*—While it is true that under ordinary care varieties of cane tend to run out, it is true that by extraordinary care the same varieties may not only be kept up to their standard, but improved upon. By systematically growing the same variety year after year, and carefully selecting only the very best for planting, a given variety may be greatly improved, and so far as we know there is no limit to this kind of improvement. This should excite endeavour to use this simple method of making progress, and in fact does do so. The matter is mentioned here only because, in spite of the obviousness of the plan, it seems to be almost entirely overlooked by Australian cane-growers.

By selection cane can be slowly improved in almost any direction we like—made to yield more to the acre, made richer in sugar, made hardier, made taller or shorter, softer or harder, in fact, as said, improved in any way we wish.

7. *New Sorts.*—There are plenty of sorts of cane grown in other countries that are unknown in Australia. The advisability of their introduction is beyond question, and the Government of New South Wales, through the Department of Agriculture, has done a good thing in importing many of these varieties. It is quite probable that the majority of the varieties introduced may prove inferior to those already grown here, but it is possible that some of them may prove superior, and this possibility should move every cane-grower to be not only willing, but anxious, to give them a trial on a small scale.

8. *Nurseries.*—A number of Australian cane-growers have established, near their houses, nurseries, in which they carry out recommendations 5, 6, and 7. The plan is highly to be commended.

9. *Selection of Disease-resistant Sorts.*—This is a subject that needs an essay by itself. I am convinced that one of the greatest improvements destined to be made in agriculture is in the line of securing pest-resisting varieties. We stand as yet but on the threshold, yet we can clearly see the alluring prospect. What we now possess in a few cases, having obtained them almost by accident, shows how on the alert we should be to discover varieties as little subject to disease as possible.

Distribution of Gumming.

In the report on the diseases of sugar-cane the following words occur:—"A farmer on the Lower Clarence told me that he saw gummed cane sixteen years ago on his farm; I have no doubt of it. The disease is probably nothing new, in fact, is very likely as old as the sugar-cane plant itself. I think it very likely that the disease occurs wherever cane is grown. It is altogether improbable that it is confined to a small district in Australia."

This opinion has been verified. The report, in spite of its length, was reprinted extensively in official public journals as well as private periodicals devoted to the sugar industry in all parts of the world, and, as one result, it has been shown that cane in Java, New Guinea, Brazil, Mauritius, &c., &c., does either now or has in the past suffered from what is beyond reasonable doubt the same disease—gumming.

The Phylloxera in Europe.

Annual Official Report by the Chief, Andres Blavia, *of the Central Government Station of Viticulture in Spain, at Cette.*

[Translated from the Spanish by HENRY CAMBRIDGE, Sydney.]

With the exception of France, where the reconstitution of the vineyards gains ground every year, the phylloxera continues to advance in all the vine-growing districts of Europe. In several countries the inroads of the evil are such, and the efforts for its eradication so badly organised, that the future of the vine culture seems to be seriously threatened.

Spain.

The progress made by the phylloxera in our country is constant, and in some places rapid, threatening seriously the existence of some of the best of the vineyards of this country. The last reports of the Agricultural Surveyors state that out of 1,706,472 hectares (2·4711 ac.) of existing vineyards over 230,000 are infected, and of these 193,418 can be considered as entirely lost.

If we take the basis of the medium yield of 17 hectolitres (2·7512 bus.) per hectare, the deficiency in the production is nearly 4,000,000 of hectolitres. This estimate is quite reasonable, and it may be that the actual loss will greatly exceed this limit. The situation then is truly alarming, and a strong effort is necessary to stop the evil. Fifteen provinces are badly infested—Lugo, Orense, Leon, Zamora, Salamanca, Malaga, Sevilla, Cordova, Jaen, Granada, Almeria, Gerona, Barcelona, Tarragona, and the Balearic Islands In the province of Tarragona over 1,C00 hectares are already affected. The districts of Valls and Vendrell, which are essentially wine-producing, suffer chiefly. In Galicia the attack is more to be feared, it being proved also that spots where phylloxera exists are known in the provinces of Lerida and Valladolid.

To sum up, the havoc caused by the phylloxera is seriously increasing, and the means adopted so far for its eradication, and for the reconstitution of vineyards, do not unfortunately cope with the intensity of the evil.

Portugal.

The situation of this kingdom with regard to the phylloxera is at least critical. There are no known statistics of the invasion, but it is known that the plague is making such rapid progress that the means that are being used to combat it are almost void of effect.

Italy.

In Italy the fight is more energetic, but the invasion even then does not make less headway, for which reason the viticulturists are seriously alarmed. The places where its propagation has extended to with great increase are

Sicily, Cerdenia, Calabria, Lombardy, Liguria, and Piedmont, which comprise the provinces of Catania, Botona, Cēme, Rome, Pisa, Ravenne, and Sardinia. Twenty-seven provinces, with 581 towns, are infested. The Isle of Sicily is the greatest sufferer. The phylloxera is combated (reated) by means of the Balbeani system.

Austro-Hungary.

By reason of the gradual decrease of its harvests, owing to the havoc caused by this plague, this empire has been obliged to revert to foreign importation, and to the coming in of Italian wines. The Hungarian vineyards, above others, are undergoing a terrible crisis; the production, already insufficient for the national consumption, tends to cease altogether. The proposed reconstitution does not fill the vacancies caused. Tokay, Szegezard, the region of Lake Balaton, Ermellek, Buda, Eger, all the renowned vineyards do not exist, except in name. Finally, Hungary, that some ten years ago harvested eight million hectolitres of wine, has descended successively to six, then four, and at present the return hardly reaches 800,000 hectolitres. In Austria and the other countries of the empire the progress of the insect is less rapid, but, for all that, they do not cease from being serious.

Germany.

The phylloxera has shown itself on various occasions lately in the renowned vineyards in the vicinity of St. Goard, on the Rhine. Various infected spots have been discovered during the past year. The official investigations have been prosecuted from the Rhine to Caub, and are to be extended this year to Remghan, beginning at Larchhausen. The German vineyards are, therefore, compromised; in fact, a spread of the evil is noted in Saxe, Wurtemburg, and in the principal vinicultural territories of the empire.

In Alsace-Lorraine the phylloxera does not appear to have made progress this year, but the year before new centres of infection were discovered, among these an insignificant one in Alsace-Lorraine, at Rouffach, which has been successfully destroyed, and another of a more serious character in Lorraine, near Metz.

Switzerland.

The number of affected spots has diminished in the Cantons of Zurich and Neuchatel, but has increased in those of Vaud and Geneva. We give below a summary of the operations, gathered from recent data:—

Cantons.	Infected spots.	Vines.	Area destroyed.
Zurich ...	... 57	244	2,250 metros (square.)*
Vaud ...	... 6	839	6,495 " "
Neuchatel	... 195	1,499	8,372 " "
Geneva...	... 170	10,129	30,221 " "

* A square metro = 1,196 sq. yds.

One infected spot, which comprises from thirty to forty vines, has been discovered between Gelly Tarleyems; another of 110 vines has been similarly pointed out in Souyettes, near Saint Prix (Lucerne).

In Switzerland the situation tends to a modification of the evil, owing to the vigorous efforts to subdue it. The Commission on phylloxera in Geneva has caused an analysis to be made of the soils in the Canton, proposed to be planted with vines, in order to ascertain if there exists among them sufficient essential difference to make it necessary to increase the number of the trial stations. Samples of soil have been taken from different types of geological formation of the country, and the analyses have shown that even in the soils

of neighbouring localities, and of an identical geological origin, very marked differences have been noted, it having been decided that the Viticultural Department in Geneva should send, to those that might ask for them, grafted plants, that each one may experiment on his own holding.

Russia.

In Russia, since 1891, the phylloxera had invaded a vast tract in the Department of Kutais. In 1892 and 1893 new infected spots were observed; similarly various localities round Odessa.

Roumania.

The progress of phylloxera is very rapid in Roumania. Since 1892 the number of infected vineyards has been doubled.

Servia.

The situation is not much better in Servia. The total area of vineyards in that kingdom amounts to 43,304 hectares, of which 9,959 can be considered absolutely destroyed, 11,259 are affected, and 22,085 only remain free from the evil.

Bulgaria.

Bulgaria is no less affected than Servia and other small principalities of the Balkans.

Turkey.

In Turkey the progress of the phylloxera is terrible, while the means of arresting its progress are not numerous, are slow, and difficult of operation.

With the hope that measures for its eradication might be taken, a Commission, instituted by the Minister for Agriculture at Constantinople, is engaged preparing regulations that will tend to the destruction of this destructive insect. Notwithstanding, the swarms are produced with every freedom, and the infection extends from vineyard to vineyard. In certain localities they recommend and use sulphurated carbon, but they do not go beyond this. In Smyrna also there exists a Commission for the purpose of exterminating the pest, which has imposed a tax on the grapes produced; in fact, in that country the vine cultivator has to pay in advance. The preliminary charges, as well as those incurred in the replanting of the vineyards, causes the boldest to hold back. Some prefer to root up all their vines and to plant onions. It must be acknowledged that the Government of the Sublime Porte has just decided to establish nurseries in various places where the American stocks may be grown.

France.

France, although barely mentioned by Mr. Guiraud in his treatise on the phylloxera, has officially declared sixty-eight departments as infected, which comprise 252 districts, the names of which we gave in our report of last year.

The methods adopted here for the destruction of the insect are immersion where it is not feasible to use sulphurated carbon or sulpho-carbonate of potash. We should mention that in localities dedicated to the growth of grapes to produce the commoner wines the vines are not subjected to any treatment, but the European vines are allowed to die out, and are replaced by American vines grafted or otherwise on that not affected, the treatment before referred to being only resorted to in the case of vineyards producing the choicer wines, and where it is necessary that the old stocks be preserved at any cost, as it has been found that the grafting process deteriorates more or less the qualities of the renowned wines.

Bee-keeping.

By ALBERT GALE.

Chapter II.

The Inmates and Economy of the Hive—The Drone.

Drones, or male bees, as will be seen, differ very much from the queen or other inmates of the hive. Indeed, so much so, as to lead casual or unobservant beekeepers into the belief that they belong to a different variety of the same species rather than being male members of the same family in which they are found. On this account drones have been very greatly maligned and looked upon as interlopers rather than factors equal in importance to that of the queen bee. That they exert a pernicious influence in the colony to which they have uninvitedly attached themselves; are dangerous to the well-being of the swarm; militate against its increase and prosperity; and operate against the financial success of beekeepers, are opinions still held by far too many bee-keepers. The word drone is associated with idleness, worthlessness, and a sponger on, or a vampire of society. It has been borrowed from the supposed uselessness of the drone-bee. A quaint old writer (Butler) says:—"The drone is a gross, stingless bee, that spendeth his time in gluttony and idleness, for howsoever he brave it, with his round velvet cap, his side gown, his full paunch, and his loud voice, yet is he but an idle companion, living by the sweat of others' brows. He worketh not at all, either at home or abroad, and spendeth as much as two labourers; you shall never find his maw without a drop of the purest nectar. In the heat of the day he flieth abroad, aloft, and about, and that with no small noise, as though he would do some great act, but it is only for his pleasure, and to get him a stomach, and then returns he presently to his cheer."

A Drone.

That drones have "loud voices," and that in the heat of the day they fly "abroad, aloft, and about," is a part of the economy of their nature, and is a factor in the perpetuating of the fittest of their race.

The external anatomy of the male bee (drone) differs very greatly from that of the females (queen or workers). In cell accommodation he occupies a greater space. Drone-cells are only four to the lineal inch, whilst the worker-cells go five to that measurement.

The cappings of drones'-cells are more convex than those of workers, and as in the case of both queen and worker, are porous. They contain not nearly so many pores as those of the former, but far more than that of the latter. When the inmates of these cells have completed their larval stage and are entering upon that of the chrysalides, they are sealed or capped over with a mixture of wax and pollen. The shape and texture of the cappings are such that they are easily thrust off by the mature inmate. The inmates of the cells spin the cocoon by which they are enclosed, but the construction of the cappings is the work of nurse bees. The cappings of brood-cells differ greatly from those of honey cells; these latter are not nearly so convex,—in fact, are in the centre slightly concave, so as to more easily resist the pressure of the honey within; they are, moreover, formed entirely of wax, and are therefore air-tight.

In developing, the drone goes through the same metamorphoses as the other inmates, but the time occupied therein is longer. From the laying of the egg to its hatching occupies three days, he remains six and a-half days in a larval form, then changes into a chrysalis and becomes a perfect insect in from twenty-four to twenty-five days. During his larval stage he is fed for about the first four days on 55·91 albumen, 11·9 fatty substances, and sugar 9·57 parts, but as the larva advances in age the two former are decreased and the sugar increased, the average being 43·79, 8·32, and 24·03 respectively.

In the wing he is more expansive, as the following measurements of Cheshire will show:—

	Length of anterior wing.	Length of posterior wing.	Ratios of united area.
Worker	38	28	5
Queen	41	29	6
Drone	49	35	9

These measurements are given in one-hundredths of an inch. From this it will be seen that the expansion of a drone's wing is nearly twice that of a worker, and one-third that of a queen. Therefore his ærial locomotive power must be far greater than either of the females. His antennæ, (organs of smell), have also a greater development of olfactory nerves, and are two-thirteenths longer than either that of queen or worker, thus his power of smelling is far superior than theirs. His eyes, notwithstanding he spends a large portion of his time in the dark, have a far keener power of vision than either female. Bees have both simple and compound eyes. The compound eyes of a queen bee have 4,920 facets, she having to spend the largest portion of her time in the dark. The compound eyes of a worker, who has to spend most of her time in the open air, have 6,300 facets; but those of a drone, although he spends most of his time in the hive, contain 13,090 facets, or nearly three times the number of a queen, and more than double the quantity of the worker; therefore, his power of sight must be far greater than that of the other sexes of the hive. Why has nature endowed him with these superior aids to sight, to smell, and to locomotion? His paternal duties are always consummated in mid-air. The race is to the swift and fight to the strong. The fleetest, the most agile, the most dexterous, and the strongest are the successful competitors in the matrimonial race when the virgin queen is on the wing. That is why "in the heat of the day he flieth abroad, aloft, and about, and that with no small noise." Drones are stingless; their abdomen is made up of seven belts, and each belt is composed of two plates—a dorsal and a ventral—the former being the larger, and overlaps the ventral on the lower side of the body. In queen and worker the abdomen has only six belts.

To sum up, the chief external anatomical differences of drones are, as compared with the workers, larger eyes, larger wings, larger body, longer antennæ, an extra belt to the abdomen, and an absence of sting, wax pockets, and pollen baskets.

The life-history of drone bees is a very short one, and, apart from the other inmates of the hive, is not interesting to the bee-keeper, but to the scientist it is fraught with the deepest interest, and is full of scope for research. The Parthenagenical production of male bees; workers becoming fertile without copulation, and producing drones only; queens that have failed in their wedding flight to meet with a consort, or that in their development or in maidenhood have been deprived of the power of flight, also become fertile without copulation, but such fertility is confined to the production of male bees only; that they are rarely produced by a queen in the full vigour of youth, health, and strength, &c., but are always produced as the queen advances in years—the older the queen the greater the abundance of males in the hive. These are subjects in connection with the "inmates of the hive" that we shall deal with later on.

Very little attention has been given to the production of high-class drones. They are the Ishmaels of bee life. Every bee-keeper's hand is against them. They have been given a bad name, and it sticks to them, and all sorts of traps have been invented for their destruction. For the improvement of other domesticated animals a high-class sire is the one most sought for the purpose. In the improvement of bees it is otherwise. A high-class dam (queen) is supposed to be the one thing needful. We have the mating proclivities of bees so little under control that breeding by the selection of males appears to be a thing of the future. As we now stand, much can be done to improve our bees by the power we have in our hands. An immediate descendant partakes of the mental, physical, and industrial character of both parents. Traits in parentage can be traced for many generations, and although drones have no father, yet there must be an influence exerted on a descendant from both sides. Parthenogenesis, as it regards drones, has been proved to have exceptions. Bee-keepers have frequently met with cross-bred drones. J. Lowe, in 1867, as recorded in Trans. Ent. Soc., says that fully 20 per cent. of drones bred from the same mother showed the mixed character of the parentage. J. Perez, in 1878 and 1880, in his investigations, obtained similar results, and P. Cameron, in an article on Parthenogenesis, in the Hymenoptera, published in the Trans. Nat. His. Soc. of Glasgow, 1888, drew bee-keepers' attention to similar facts.

Sometime ago we submitted the following series of questions on this point to some of the most observant and practical bee-keepers of the colony:—

1st. Have we hybrid drones?

(The term hybrid to mean a crossbred. Hybrid is a misnomer as applied to a cross between varieties. A hybrid is an intermediate between species, variety is subordinate to species in the same manner as species is subordinate to genus.)

2nd. What are the markings of the progeny between the first cross of a pure Italian drone (Ligurian) and a black queen?

3rd. What are the markings of the progeny between the first cross of a black drone and a pure Italian (Ligurian) queen?

4th. A drone two removes from a pure Italian queen. What are his markings?

5th. Through how many generations of drones can you trace Italian blood?

To all these questions we received answers from every one to whom we applied, and from which we compile the following answers:—

1st. The general opinion is "No," as it regards markings or appearances. The drone progeny from a queen that has mated with a drone of another variety partakes of the nature of both parents, but the maternal nature always predominates. Two very striking instances in proof thereof are mentioned. The writer says, "I bred a solid yellow American queen, not a particle of dark colour even at the tip. (Sixth dorsal plate.) This queen was mated with a Ligurian (Italian) queen. This queen, during the Summer of 1893–94, produced, being young, evenly marked drones, almost yellow (samples of them were forwarded by Mr. Mansfield, Largs, to the Technological Museum, Maitland). During the Summer 1894–95 about 10 per cent. of drones from this same queen varied from the characteristics of the typical Ligurians." In the second case there was a similar result, but the mother bee was one remove further from the American blood by that of Ligurian, in this case there were between 40 and 50 per cent. of the drones showing Ligurian markings.

2nd. The male progeny partakes of the paternal colour and markings, with the exception that the hairs on the abdomen are browner and more dense near the tip.

3rd. The same markings as those from a pure Italian queen, i.e., the three bronze bars on the upper edges of the abdominal segments, each of these bars being somewhat narrower than those of the cross mentioned in No. 2 answer. Occasionally there is a darker patch of bronze extending from the first and second dorsal-ring, and partly down each side of the segment. The rest of the abdomen is black. Of the specimens forwarded to the Maitland Technological Museum the donor says, "Many persons are disappointed in the appearance of these drones, and it would be a good thing to make these characteristics more generally known."

4th. These drones vary in their markings similar to that of the workers, the black blood showing itself more prominently in some of the progeny, and again in others of the same family the Italian markings predominate.

5th. None of our correspondents have traced as yet the Italian blood beyond the third generation. This is a point well worthy of careful investigation.

For breeding purposes the strongest male bees should be used. As stated above, the strongest drone is naturally the selected male, selected by his own powers of flight, &c. Weak drones, whatever may be the cause thereof, can only perpetuate weakness.

Drones are tolerated in the hive and admitted from others as long as there is a probability of a queen requiring fecundation. But let the honey-flow suddenly cease, and in a few days every one in the hive is banished.

As soon as the honey-flow is no longer abundant the edict is sent forth for the destruction of all the males of the household. There is no mercy shown. The old and the young, egg, larvæ, and chrysalides, must all suffer the same fate. The only crime for which they have to suffer is they are masculine. Those males, that a few weeks before were so active and strong on the wing, when the general order has gone forth for their destruction, offer no resistance. They readily submit to be slaughtered, and those very nurse bees that were so watchful of their well-being at once become their executioners, until the whole of the male sex of that hive is exterminated.

As queen bees mate but once during life, the drones that are required for the following season are the progeny from the same mother and are full brothers of the slaughtered victims of the previous year.

How often has the question been asked, "Why are there so many drones?" and what queer answers have been given to it. To produce extra heat, to aid in the ripening of the honey, food for birds, &c., are the answers that have been given. It must be remembered, as stated above, that conjunction between the queen and *one* drone takes place but once during the former's lifetime, and such conjunction must take place when the queen is about six days old, although cases have arisen where queens have successfully mated for some time after that period. If there were a scarcity of drones the queen may fail to meet her mate and become a drone-layer. The superabundant number of male bees to one female is analogous to the great number of stamens and anthers in a peach "blossom" or other bloom to the one or few carpels in the flower. One grain of pollen from one stamen is sufficient to fertilise one ovule, then why so many stamens and pollen grains is a question the answer to which has never been doubted. Undoubtedly the same answer as it regards the excessive number of drones applies in this case.

To our mind an excess of useless drones is an argument against the ability of the bee-keeper, or a want of knowledge of the age of his queens. Drone over-production can be minimised by judicious management. Young queens, and closer spacing of brood-comb when necessary, are about the best drone-traps that were ever invented.

For high-class drones, select an old queen, one that has a record of good traits, perhaps the older the better. If she has produced workers up to your ideal standard of usefulness, there is a moral certainty that her drones will be of equal merit. To a certain extent in this way good drones can be selected. "It is not fully true that the drone *is* beyond control," says Cheshire. With care, selected drones can be so secured for the purpose of mating with selected queens. When a queen is 5 or 6 days old, and unmated, close the hive she occupies at night, and remove it to a cool dark room, and keep it there till the afternoon of the second day; return the hive to its original stand. A nucleus hive is the most handy for the purpose. Before returning it to its place, feed all within with heated honey diluted with warm water. Before liberating the queen and other inmates of the hive, be satisfied there are no drones on the wing. This may be done by listening for their deep bass hum, and noticing the entrances of the surrounding hives. It is better to have two nucleus hives for the purpose. One should contain the virgin queen and the other the drones, wherein there is a fertile mother-bee. When the nucleus hives are placed on the stand in the sunlight, it will cause great excitement in both hives. The queen and drones will at once rush out, and there is a moral certainty that the object sought will be attained.

The Dairy Industry in Denmark.

By F. E. H. W. KRICHAUFF, Cor. Mem. R.H.S.,
Chairman of the Agricultural Bureau of South Australia.

After considerable delay I have at length secured a copy of the full report, in 133 pages, by Professor C. C. Georgeson, of Manhattan College, Kansas, U.S A., upon "The Dairy Industry in Denmark," which I have endeavoured to condense into the following pages. Since the publication of the Professor's report the progress of dairying in the United States has been most remarkable.

Whilst giving the fullest credit to Mr. David Wilson, of Victoria, Reynolds & Co., of New Zealand, A. W. Sandford, of South Australia, and many managers of dairies in Australasia, and others, for improvements in our system of dairying, we can all agree with Professor Georgeson that the Danes are ahead of the rest of the world as regards butter-making. He says that the leading secret of the uniformly good quality of their butter is that "pure cultures of cream ferments" are in common use in all good dairies exporting butter. It always has the same bright straw colour, the same degree of saltness, and it varies but very slightly in flavour, aroma, and texture; and this uniformity in quality gives both dealer and consumer confidence. Most of the exported butter is made in co-operative dairies, of which there were more than 1,000 (now probably nearer 1,500), besides about 400 owned by private individuals who purchase milk from smaller farmers. The first of these co-operative dairies was started in 1882—probably the first in existence.

Mr. E. B. Young, of our Wine and Produce Depôt, telegraphed on April 22nd 1895, recommending the pasteurising (*i.e.*, sterilising) process and the use of selected yeasts (meaning pure cultures of bacteria), to counteract the "fishy" flavour of Australian butter. I had long held the same opinion, and had again written to the Bacteriological Station at Kiel, Holstein, for such pure cultures, as some of these had been successfully introduced into New Zealand, although apparently neglected or lost through the want of refrigerators.

Notwithstanding the most scrupulous cleanliness in milking-sheds or stockyards, and in the vessels used, it is not possible to avoid disagreeable flavour or to retain the aroma unless the milk or cream is sterilised and inoculated as soon as separated, with the particular bacterium in sufficient quantity, which will give the desired aroma and prevent the action of all organisms producing bad flavours. These latter float in the air—especially the butyric acid bacillus, which causes rancidity—and are not present in the milk as drawn from the cow. We too often forget the discovery made by M. Pasteur in 1860, that the process of fermentation is due to the presence of living organisms, or bacteria; and the buttermaker should imitate the

practice of the brewer, who, instead of leaving the fermentation of his beer to chance and uncertainty, carefully cultivates a yeast containing only those bacteria which will give his beer the taste and aroma desired, and thus he secures a complete mastery over the fermentation.

The report is valuable, not only as evidencing how the Danes have adopted the teachings of science in their practice, but also as showing how much of their success is due to the wise aid given by the Danish Government to private enterprise. The increasing demand for Danish butter in England was and is largely due to the services of a civil servant, an accomplished scientist (Mr. M. Faber), whose duties were to aid by all means the sale in England, and to meet and correct through the press all false and damaging statements concerning Danish agriculture, and particularly the dairy industry. He had also to direct attention to frauds and adulterations with oleo-margarine and the like.

Professor Georgeson remained in Denmark from January 27th till March 6th, 1893. The population is about 2,000,000; contains 14,553 square miles; has a mean temperature of 43·7° Fah. to 47·3° Fah., and about 24 in. of rain—never a complete failure of crops on account of drought. Large farms seldom contain more than 500 to 1,500 acres, of which class there are 1,954. Of medium farms, containing from 50 to 500 acres, there are 71,778; and smaller farms number 150,260. The average size of farms is about 30½ acres, if we exclude forests and waste lands, and take only what is under cultivation and in grass. These statistics are some years old, and the subdivision of the large estates is being carried on. Farmers now own more than 50 per cent. of the area under cultivation, and the greater portion of the remaining land is worked by peasants under a life tenancy, which can be held by the widow so long as she does not remarry. They are thus sure of any improvements made by themselves, and the condition of agriculturists is prosperous—more especially in comparison with the period before the astonishing output of dairy products. In 1891 the total quantity of butter made was calculated to have been 170,074,642 lb., of which 100,600,788 lb. were exported; and this from a small country, which contains in the Jutland Peninsula a very large quantity of poor heathy land. The kingdom is one-tenth the size of California, and less than one twenty-sixth the size of South Australia, exclusive of the Northern Territory. The number of square miles *alienated* in South Australia is somewhat in excess of the *total area* of the Danish Kingdom.

State Aid and Progress made in Dairying.

Up to sixty or seventy years ago dairying had been neglected in Denmark, except upon a few of the larger farms, and the breed of cattle was very poor. Farmers were best pleased with fattening a number of steers for the market; but since then matters have improved, first with the introduction of skilled dairywomen from Holstein. But it has been only since 1850 that smaller farmers began to take an interest in the dairy, and the Agricultural Society provided practical instruction for young men, as already had been provided for young women. Professors T. R. Segelka, von Stoch, and Fjord began in 1874 to change the empirical methods, by pointing out the reasons for the new practices to be followed, and showing how better results could be secured by the adoption of more exact methods. The thermometer was used instead of the finger, the milk from each cow was recorded, the quantity of cream weighed, the food and labour placed to the debit of each cow, and set against the product yielded by her. The separator, in 1878, began to

supersede the system of straining the milk into shallow pans or tubs, as introduced from Holstein. Instead of cooling the milk by water ice was used in tubs or cemented basins in the cellars, and the milk set in deep cylindrical cans sunk in them, but the separator entirely did away with setting of the milk in cans on all of the larger farms.

(For farmers who have no separator I think the following account of experiments conducted by Professor Fjord will be valuable, and induce them to at least use as cold water can be obtained :—He experimented largely in order to ascertain the relative values of setting milk in cold water and in ice water, the former ranging from 39° Fah. to 60° Fah. He proved conclusively that the milk ought to be at once cooled to a temperature as near to freezing as possible, and that the depth of milk in a can had but little influence on the rapidity of the rise of the cream *if* kept in a low temperature. From milk skimmed after standing ten hours he obtained nearly 3¾ per cent. more cream if cooled in ice to 35° Fah. or 36° Fah. that if kept in still water at 39° Fah. to 40° Fah., and more than 25 per cent. excess if the water was only 50° Fah. If skimmed after thirty-four hours the loss was respectively 1·4 per cent. and 13·4 per cent. Milk standing thirty-four hours gave in either case much more butter than if the cream was taken after ten hours. The loss, if skimmed after ten hours, was 5·7 per cent. when cooled with ice, and 9 per cent. when cooled with water at 39° Fah., and 29·4 per cent. with water at 50° Fah. With regard to losses in butter, it may be remarked that making sweet cream butter is like losing 1 lb. of milk for each pound of butter if compared with first souring the cream.)

The Danish dairies have not reached a high standard, and the average butter fat is under 3½ per cent. On the islands the Angler breed of Schleswig-Holstein cattle have been largely imported to blend with the native "Red Dairy" breed; also some Shorthorns, Ayrshires, and Swiss cows have been introduced. There is now a gradual development of the milking qualities of this "Red Dairy" breed. While formerly the yearly average yield of milk from cows was from about 4,200 lb. to 5,300 lb., there are now good average cows yielding, if well cared for, from 8,000 lb. to 9,000 lb., and a few up to 10,000 lb. In 1868 the yearly average yield of butter per cow was 112¾ lb. in 1872 it was 146 lb., and increasing ever since. The Jutland breed is black and white, and the dairy qualities are not well developed; they are better suited for beef. They resemble the Holstein-Frisian breed, but the cows are rather small where the soil is poor. The average yield of milk was, in 1892, between 3,500 lb. and 4,500 lb. per year. In exceptional cases, after selection, the average of some herds was as high as 6,500 lb.

The management of calves in Denmark is worthy of notice, especially in the south-east and elsewhere where tuberculosis has a foothold. The calf is at once put into a pen by itself, and within a couple of days it is injected with tuberculine, to test whether or not it is affected with tuberculosis from its mother. If there is a reaction from this injection, shown by a rising temperature, then it is killed at once. The healthy calves are put together by twos until they are two months old, and then four together, until spring, when they all have access to a yard. In May, before being put upon grass, another injection of tuberculine is made, so as to be quite sure to have a herd free from tuberculosis. This disease is so frequent that the affected cows could not be all killed at once. The germs of the disease are without fail indicated by tuberculine, Professor Koch's great discovery.

All farmers in Denmark strive with might and main to improve their stock, especially through "bull associations." At Ringe, in Funen, for instance, twenty-nine farmers owned a superior bull. They selected 100 of their best

cows, and he was put to none but these. Inferior cows were not eligible. The service fee was nearly 8s., to provide for the keep of the bull, but the State paid one-third of it. Altogether a yearly sum of about £2,700 is devoted by the State to this purpose. But the State pays in many other ways for the advancement of agriculture and dairying in particular. There are ten private agricultural schools, each of which receives State aid, according to the number of students, up to £162 a year. Besides these, there are somewhere about 100 ordinary high class schools, which give agricultural instruction, and about 2,000 dairies take pupils who receive board and lodging and a small salary for their services. The Royal Veterinary College of Copenhagen has ten professors besides assistants and lecturers, and nearly 400 students who pay; the State pays annually £324 for the instruction of twenty-two students, and the annual appropriation for the college, irrespective of salaries of the professors, is £1,762. For enlargement of the institution, £44,711 has been voted. The State pays for nine "Konsulenter," or advisers, who deliver lectures and answer questions pertaining to agriculture, three of whom are specialists in dairy matters. Persons requiring the services of either of these advisers pay a portion of his travelling expenses, and give him board and lodging whilst at the place.

Dairy Utensils and Butter-making.

In Denmark the Burmeister and Waine separator is mostly used. It can raise the skim milk and cream through its discharge pipes to a height of 8 ft., whence it runs by gravitation to reservoirs. It is the only separator which will do this. The DeLaval "Alpha" separator is gaining favour, and another separator manufactured by Koefoed and Hauberg is used to a considerable extent.

The vessels in which the cream is set to ferment are mostly wooden barrels, made of oak, or in some places large tin cans. Sometimes the latter are fitted into a wooden tub, with the object of maintaining an even temperature. The receiving tank, into which the milk is poured after it has been received and weighed, is sometimes of wood, and in other places made of heavy tin. It is always placed on a high platform, so that the milk can flow by gravitation to the separators. The milk should be raised to a temperature of upwards of 75° Fah., and it is necessary there to heat it by steam, by passing through a jacketed tin or copper vessel placed inside another, so that the space between them is filled with steam, while an "agitator" revolves slowly in the milk to warm it evenly. To regulate the inflow of the milk into the separator, Professor Fjord invented a regulating funnel. Others put a "swimmer" in the funnel, which rises up against the end of the discharge pipe, partially closing it if the milk runs too fast. The cream from the separator runs from a suspended vessel through the steriliser to the cooler. Professor Fjord's steriliser or pasteurising apparatus is a copper cylinder, covered with tin, fitted steam-tight into a somewhat larger vessel of copper or galvanised iron, and then "lagged" outside with wood to prevent cooling. The steam passes direct from the boiler between the two vessels, and out by a pipe at the bottom. The milk or cream enters the vessel, which contains an agitator, from below and flows out near the top, where a thermometer can be inserted: The temperature must be from 170° to 180° Fah., and is intended to kill the microbes or bacteria. The steriliser is used for sweet, or for skim milk, or for cream. In nearly all cases where the sweet milk was sterilised before separation Mr. Georgeson found that the skim milk

was again sterilised before leaving the separator, as if then fed to the calves it was claimed that all possible danger of infection with tuberculosis was avoided.

The cream, after passing through the separator and steriliser, must next be cooled. It is poured into a hopper on top of the cooler. This is either a round or square apparatus of corrugated metal containing a worm or thin zigzag pipe, into which cold water enters from below, passes through the pipe, and is discharged again below. The water is supplied from a vessel which contains broken ice, placed high enough to force the cold water through the pipe. The cream, on running in a thin stream over the corrugated metal, is cooled, so that a cooler 3 ft. high may cool 5,000 lb. of milk per hour from 180° Fah. to about 33° Fah. above the temperature of the ice-water. It requires 30 lb. of ice to every 100 lb. of milk to reduce the temperature to at least 41° Fah. (The difficulty in Australia may be to obtain artificial ice at a low price. In Denmark they store ice in winter near to the dairy. Well water, formerly used in Denmark, cannot lower the temperature sufficiently. The difficulty might, perhaps, be overcome by placing water beforehand in a freezing chamber, if such is attached to the dairy.) The sterilisation and the cooling can, however, be done without the aid of the steriliser and cooler, but it involves more labour. The cream must be put into tall cans, which have first been thoroughly cleansed by washing in mild lye, or by the addition of soda and a solution of lime to the water, and thereafter pouring scalding water or a jet of steam into them. After filling the cans sink them in hot water up to the rim and keep it near the boiling point by the addition of boiling water or a jet of steam. The cream must be kept constantly stirred with a paddle of galvanised iron, also thoroughly cleansed before use. When the thermometer shows a heat of 80° C. (176° Fah.), the cans are at once removed and immersed in ice water, and the cream is kept constantly stirred until it is rapidly reduced in temperature to 35° Fah. or 36° Fah., and remains now free, or nearly so, from bacteria of all kinds, until it is convenient to begin the fermentation.

A few of the smaller farmers, however, do not artificially sterilise their milk, but allow it to sour naturally, and may make thoroughly good butter, provided the temperature is not too high, the milk is from healthy animals, the stockyards, dairy utensils, store-room or cellar clean, the air free from bad odours (even those arising from cheese), distant from dungheaps and stagnant waters, and finally, if the manipulation is perfect. But there are so many favourable conditions necessary to ensure butter of first-rate quality that it is necessary to adopt the most modern methods of fermentation, and this practice is becoming more and more general. In every case the temperature of the cream should be raised to between 70° Fah. and 95° Fah. before the butter milk or other ferment is added. The easiest way to do this seems to be to immerse a can filled with boiling water in the cream, which should be stirred, or else by means of a "fore-warmer," or by immersing the cream can itself in boiling water.

The methods of fermentation are—Firstly, the addition of a portion of the butter milk (taken from the churn immediately after the butter is removed) to the cream barrel. The *quantity* differs according to the *quantity* of fresh cream, the sourness of the butter milk, the season, and also to the length of time the butter-maker desires to give to the souring. The quantity may vary between 5 and 10 per cent. The objections to the use of butter milk are that if there is any defect in the churning from which it is taken those undesirable qualities are of course transmitted. In such a case it is a common practice to resort to a neighbour for butter milk. It varies also

much more in acidity than any other ferment, and it is more difficult to manage the fermentation. In the cool season, to prevent the falling of the temperature in the cream barrel to too low a point whilst the souring is in progress, the room is kept warmed by a stove or steampipe, or the barrel is placed within a larger one, so that it can be packed all around with hay and the lid covered with a quilt. The proper degree of sourness being usually reached within eighteen to twenty hours, the ferment should be added about noon, when churning can commence at 6 o'clock next morning. In the interval the cream should be thoroughly stirred twice or three times. Secondly, a portion of the sour cream churned in the morning is occasionally added at noon to the cream to be churned next day; but this practice is even less desirable than that of adding the butter milk. Thirdly, it is best to make fresh ferment every week or two to prevent its degeneration through using either of the two former methods. Usually it is made with half skimmed milk from a nearly fresh milking cow, and which has stood no more than ten to twelve hours. This is heated to about 100° Fah., and then allowed to stand at a temperature of about 70° Fah. for twenty-four to forty hours, according to the season, when it will develop the ferment, but good judgment is required to obtain the right degree of acidity by smelling, tasting, and testing its strength. It should have a certain degree of density, show the formation of small granules, and have a clear sharp taste. Reject it if it smells or tastes badly, and does not thicken properly. As soon as approved the fermentation must be stopped by immersing the can containing it into cold water. From 3 per cent. to 5 per cent. of this ferment is added to the cream barrel after the top of the ferment has been thrown away, as it may contain injurious bacteria from the short exposure to the air. This method is not always satisfactory if the dairy buildings or the surroundings are impregnated with injurious bacteria, which are sure to infect the new ferment and cause it to fail.

Fourthly, the pure cultures of the beneficial bacteria, isolated and cultivated in bacteriological laboratories, are thoroughly safe to give a first-class butter, and are in common use in Denmark. Presently they will be introduced into all the large dairies in the United States of America, and, although the local consumption there will absorb all the first-class product for some time to come, we should not lag behind. Professor Conn has now isolated bacterium No. 41 from the best June butter, and by inoculating winter cream with it has been enabled to impart the June flavour and other fine qualities to the butter produced from it. Expert bacteriologists will soon be able to isolate and cultivate bacterium No. 41 for the use of dairies all over the States. In Denmark the pure cultures were also obtained from the finest butter, but, whilst in one laboratory they separate only two beneficial bacteria, others isolate and cultivate several.

The purchasers are instructed how to apply these bacteria to the cream. One laboratory sells its ferment in bottles holding about a pint, which must be used all at one time. The pure culture is added to a small portion of sterilised milk or cream, and then set aside at a given temperature until it has attained the proper stage. It is then further propagated in more milk or cream, and when a sufficient quantity has been obtained it is added to the cream in the barrel, where it effects the necessary fermentation in eighteen to twenty hours. Up to the time of Professor Georgeson's visit the ferment could not be perpetuated outside the laboratories for any length of time, and it will always be a matter of greatest care to isolate the beneficent from the harmful bacteria. This work will probably have to be left to specialists. The pure cultures are, however, reasonably cheap, and may become cheaper

with the increasing number of bacteriological laboratories. At the Bell Springs Creamery, Professor Georgeson tried samples which he had purchased from Mr. Quist, and they had a decided influence on the butter, the quality of which was superior to any previously made there, although the cream had not been sterilised. The cultures had to be specially prepared for their transit to Kansas, being on the road from the 10th March until the 5th June. One was in milk sugar, and one in a nutritive fluid of Mr. Quist's invention. In Denmark, where these cultures are only a few days prepared before use, they are cultivated in skim milk. It is to be hoped that Christian Hansen, who has now established a branch of his laboratory in America (or some other bacteriologist), will start one in Australia.

In order to obtain the finest quality of butter, that will keep well, the fermentation must be strong, and should not be stopped until the cream has become thick and shows a peculiar granular appearance, developing the pleasant aroma of good butter. This is the time for churning. The cream should be of a temperature somewhere between 50° Fah. and 70° Fah., usually between 55° Fah. and 60° Fah. The milk from fresh cows does not require so high a temperature as that from cows about to go dry. It is better to churn at a low temperature, as the grain of the butter will be better preserved. If the butter fails to come within half an hour the temperature is not high enough; and in obstinate cases it is better to allow the cream to stand until next morning, after warming it to 5° Fah. or 6° Fah. higher. A stick with a deep furrow in it is inserted on one side of the churn through a hole in the lid, and is lifted from time to time to show the size of the granules of butter; when they are the size of small peas the churn is stopped, else the grain of the butter would be injured. After a small quantity of cold water has been thrown inside the lid and down the sides the dasher is started again slowly until the butter has sufficiently gathered. In many places they are careful to use water that has been boiled and quickly reduced to about 60° Fah., for washing down the sides of the churn, so as to avoid contaminating the butter with any harmful bacteria the water might have contained. The butter is next gathered in a sieve—usually of fine hair—and put into a tub, and the butter milk is run through a strainer to collect any butter yet remaining in it. In but very few dairies is the butter touched with the hand; but, at any rate, if the hand is used it should be clean and cooled in water. The butter-worker is generally used, all implements and utensils being first washed in boiling water and then in clean cool water. The amount of salt added varies from 4 per cent. to 5 per cent. of the weight of the butter, as may be required in the particular market where it is to be sold. The butter is then placed in the butter-cooler, unless it be the cold season. After the salt has dissolved and penetrated the whole mass, and the butter attains the proper degree of firmness, it is again put under the butter-worker to work out the last of the butter milk and a portion of the brine formed from the salt. Frequently the butter receives another working one or two hours later, but care is taken not to overwork it, and thus make it greasy.

The churn used in Denmark is like our old upright, truncated barrel churn, but suspended by pivots near the centre of gravity, resting on upright posts, so that it can be easily tilted to any angle. The cream is churned by a revolving agitator of wood, and sometimes three or four cleats are nailed to the inside of the churn to break the rotary motion. The butter-cooler is used everywhere during warm weather, except in a few very small dairies. This is a box made of wood or zinc, containing one or more cleats inside, and slats are laid across these, upon which the butter is placed, sometimes rolled into the

form of an arch, from the butter-worker, and remains there until it can be worked up. On the lid of the box is placed a layer of broken ice, and the ice water runs to the bottom of the box.

The Danish butter is always packed in barrels by means of a wooden mallet. Generally they contain 112 lb., and are manufactured on the farms from staves of beech held together by wooden hoops. After they have been scrubbed in scalding water they are filled with clean cold water, and then well rubbed inside with salt. Half an inch of salt is put in the bottom, and the sides and bottom are lined with paraffin paper. The butter is pressed into the barrel in lumps of 10 lb. to 12 lb. at a time until it is slightly above the top. The surplus is cut off with a sharp spoon, paraffin paper laid on, then a thin layer of salt, the lid put on, and then the hoops are tightened up. At Valdemar Castle the paraffin paper is soaked in brine for several hours, and thereafter in saltpetre for half-an-hour. Each barrel is rolled about for some time once a week, in order to prevent the brine settling too much in one part of the butter.

I think it is a good plan to have the weight stamped on the milk cans or on a brass plate soldered to the can, whereby the weighing of the can every time is rendered unnecessary.

The Danes use Professor Fjord's control apparatus in place of the Badcock milk tester, which latter involves the use of chemicals, but they are not needed with the Professor's method. The Milk Supply Company is an exception to the rule. Without the drawing which accompanies the report it is impossible to sufficiently describe the control apparatus, but when perfectly handled it works with perfect accuracy.

The butter and cheese making in a number of creameries is fully described by the Professor. The creameries own all the cans and transport waggons; but the teams and drivers are hired and paid for at from 2½d. to 3½d. per 100 lb. of milk carried, according to the length of the route. As the majority of the members own only from one to ten cows, this is a great advantage for them. The sterilised skim milk or butter milk is also delivered by the carrier in the evening. As the members generally milk three times a day the milk of noon and evening is kept at home in cold water or ice water until next morning, when the carrier fetches it. On receipt of the milk it is weighed, tested twice a week at uncertain times, and payment is made in proportion to the percentage of fat, ascertained by means of the aforesaid control apparatus. If anything is found wrong with any sample a case of small bottles of this apparatus is sent to the farm, and the milk of each cow is there sampled, so that the milk of any particular cow may be excluded. For skim milk or buttermilk from three-quarters of an öre to one öre per 100 lb. is paid by the farmers. (This is equal to $\frac{1}{8}$d. to $\frac{1}{6}$d.) On top of the creamery roof is sometimes kept a large reservoir, kept always full of cold water pumped from a well, which makes it easier to have cold water in all parts of the creamery. The manager generally receives a salary from which he must pay his assistants, and he also gets paid from any surplus which the butter may bring over the highest quotation on the exchange in Copenhagen. By becoming thus financially interested he will try to produce the finest quality possible.

Professor Georgeson visited Mr. E. A. Quist, a noted bacteriologist, who owns a creamery at Nonnebjerg, near Skanderborg, which he equipped chiefly to afford him opportunities for testing his pure cultures. He sterilises the milk as soon as received at a temperature of 167° Fah., and runs it at once through the separators. He would not separate at a lower temperature than 95° Fah. At 167° Fah. there remains $\frac{15}{100}$ of 1 per cent.

of fat in the milk ; at 95° Fah., $\frac{12}{100}$ of 1 per cent. ; at 77° Fah., $\frac{22}{100}$ of 1 per cent. of fat. At a higher degree of heat than that required for their development is destructive to the bacteria, so does a reduction of temperature ret3rd their growth, and destroys them if below the freezing point.

Cheese-making.

The calves receive whole milk for fourteen days only; after that it is gradually substituted with skim milk, and after the pigs have received their share the rest of the skim milk is used for cheese-making. The milk is warmed from 88° Fah. to 95° Fah , and sometimes from 8 per cent. to 10 per cent. of butter milk is added with the necessary rennet ($\frac{4}{100}$ part of a pound of rennet extract to 350 lb. of milk), and, if thought requisite colour also. After standing twenty to thirty minutes the curd is cut and then stirred fifty-five minutes (in another place twenty minutes are mentioned), and Mrs. Hermansen's method differs from others in that she did not permit the curd to be worked until it has been put under the press. She maintains that it makes the cheese tough ; nor should it be allowed to cool before it is put under the press. The temperature meanwhile may have fallen, and must be raised again to 96° Fah. by admitting steam under the vat. After drawing off half the whey the curd is worked by hand, ¼ lb. of salt is added for each 100 lb. of milk, the curd is put into hoops and given half pressure. After half-an-hour it is turned again and replaced under the press. Two hours later it is again turned, and then full pressure is applied. Finally, in the evening, it is turned again and fresh cloth wrapped about it. Next morning it is taken from the mould and placed in strong brine for two days, when it is placed in the cheese-room in a temperature of 52° Fah. to 55° Fah., and turned daily for three months, and rubbed with salt or strong brine once a week. This cheese sells at 3d. per pound.

Mrs. Neilsen, a renowned practical dairy-woman and teacher of dairying as well, who supplies the King of Denmark every day with dairy products, and the Emperor of Russia with cheese, has her cows milked by her pupils at 4·30 a.m., and as soon as the milk is received, weighed, and strained, takes as much as is desired for sweet-milk cheese. This is warmed to 88° Fah. by setting the cans of milk in kettles of warm water on the stove. She adds 6¼ lb. of skim milk to every 100 lb. of sweet milk, and, on reaching the temperature of 88^c Fah., the rennet is added at the rate of $\frac{3}{100}$ lb. of the fluid to 100 lb. of milk and a little butter-milk. After it has coagulated (in twenty-five minutes) it is cut with a curd knife and gently stirred to separate the whey, but maintaining the temperature. When the curd has settled at the bottom the whey is drawn off, the lump of curd quartered, and the outside turned into the middle of the vat in order to drain it equally and make it of the same consistence throughout, else it would be firmer in the middle. The curd is next broken by hand into large pieces after the whey has drained off, and these are packed into the cheese mould with layers of carraway seed. No salt is added. The cheese mould can be enlarged or made smaller by the addition or removal of rings. At first but very light pressure is applied for about half-an-hour, then the cheese is turned, pricked through and through with a prong. About an hour and a half later, and again in an hour, and then four hours after, and once more in five hours the cheese is turned and turned again, and finally left in the press until next morning, when it is taken out of the mould, rubbed with salt and put into a wooden bowl with round bottom, where the sharp edges are removed and the cheese takes a rounded shape. Rubbing with salt, and turning in this bowl is

repeated three times a day for four days, and then it is put into the cheese room and rubbed with salt once a day until six weeks are passed. It is then removed to a room with slightly cooler temperature, and rubbed with brine every other day until it is sold. This rubbing keeps the rind soft, and the cheese is covered with a fatty layer drawn out by the salt, which prevents the access of air to the interior of the cheese. This cheese is sold at 1s. per pound.

Mrs. Neilsen also makes every morning from whole sweet milk a Camembert cheese, which is specially rich. The milk is warmed to 100° Fah., when $\frac{1}{100}$ lb. of rennet is added to each 10 lb. of milk, which, after gentle stirring, is allowed to stand until in four and a half hours time it has coagulated to the proper degree. The vat used is a large earthen jar, which is kept wrapped up near the stove, to retain the temperature of 100° Fah. When coagulated the curd is cut into small cubes, but is not worked or pressed in the least. Curd and whey together are dipped out and put into small tin rings of moulds with holes in the sides, but with neither bottom nor top. Each mould consists of two rings, one placed on top of the other, making it 6 in. hight by 5 in. diameter. They rest on a mat made of clean stiff rye straws, single straws being tied parallel to each other, and placed in a strainer on top of a vessel. The mat facitates the turning of the cheese after the whey has drained off. When the rings are filled they are left for eight hours in a warm place near the stove; by this time the cheese has settled so much that the upper ring can be removed, and the cheese is turned, but left in the mould over night. Next morning it is again turned, salted on one side, turned in three or four hours and salted on the other side. No pressure is applied at any time, and the temperature is kept above 78° Fah. After the second salting it is firm enough to be taken out of the mould, and is placed in a room of 55° Fah. to 60° Fah., where it remains two or three weeks, and then is placed in the cheese room with a somewhat higher temperature. It is ready for sale in two months, weighs $\frac{3}{4}$ lb., and commands 13d. each. She makes fourteen cheeses daily of this kind from 80 lb. of milk. Sometimes she adds a little cream to the milk before curdling it.

Madame Neilsen makes Myse cheese every morning from the whey obtained from the other cheeses, adding to it the milk of half a dozen goats. Six enamelled pots, each holding several gallons, are placed over the stove for evaporation, being constantly stirred and kept boiling. The quantity decreasing, the contents of one pot are poured into another until one pot contains the whole. Stirring is now constantly kept up, and the mass becomes so thick that it must be removed to a trough, where it is pounded and beaten with a club like a potato smasher, and when homogenous it is tamped closely into a square wooden mould and put under pressure. It forms a greenish-yellow sweetish mass, rather agreeable to the taste, and very nutritious. (At home, I have frequently had Myse from Norway at my breakfast, and can confirm this.—Ch. Ag. Bu.) No rennet is added, nor any flavouring; but it is ready for use directly it comes out of the mould, and it keeps for a couple of months, but should be kept covered to prevent it drying up. It sells at 1s. per pound.

A Small Model Farm.

Out of seventeen farms described by Professor Georgeson, I select this as showing what an energetic man can do on only seven acres of land. P. Pedersen, a teacher in a village in Tunen, holds land of an ordinary quality, with clay sub-soil, since 1876. One acre is used for buildings and an orchard.

The other six acres are divided into five lots, one being kept for hay and grazing; the other four are cultivated in a four-year rotation. After rye and soiling crops, one acre was planted with roots, potatoes, and green peas; the third year with barley and vegetables; and the fourth with grass and vegetables. High manuring and thorough cultivation made it possible to keep four high-class dairy cows and one heifer. The liquid manure was kept in a cistern, and applied to the grass land, the fruit-trees, and plots devoted to seed-growing. The solid manure was applied to the root crops, the soiling crops, and the vegetables. He kept two brood sows, and fattened yearly eight to ten head of swine. He purchased yearly 200 lb. of kainit, 400 lb. of Thomas slag, and 200 lb. of Chili saltpetre, which he used for the grain crops, for his cows were fed both winter and summer to some extent on grain. He tethered them in summer for two hours daily on good pasture. (Tethering the cows and calves to a 20 ft. rope is very general in Denmark, even on large farms, as it is considered that it is the most economical way of using the pasture to begin at one side and gradually moving on to the other side.) The entire herd is shifted five times a day, each cow being given 3 ft. or 4 ft. of fresh pasture at each change. Pedersen's five head of cattle consumed 10,788 lb. of grain feed mixture ground together, valued at £33 4s., and hay and roots at £12 16s.—all of which, except some oilcake, was produced upon the place. The cows gave 30,438 lb. of milk, for which he would receive, at the co-operative creamery, £58 16s.; but he made more of it in butter and cheese at home. The heifer sold for £9. The swine ate 8,845 lb. of grain, together with the whey and skim milk, not otherwise used, and offal from the garden, on which he put a total value of £40 16s. He slaughtered three for home consumption, and sold seven, also twenty-one sucking pigs, for £49 6s. The sum realised for fruit, vegetables, and seed was no inconsiderable item, but was not mentioned by Pedersen, and may be at least set against the expense for manure. He and his family had, however, everything from the seven acres and £30 6s. in cash, even if the milk had been sold to a creamery.

The Milk Supply Company of Copenhagen.

This company delivers somewhat less than one-fourth of the milk consumed in that city, at a slightly enhanced price; but it is absolutely pure and wholesome. Forty-two dairy farms, with 4,600 cows, supply the milk under the strictest rules as to cleanliness, feeding, cooling the milk, &c. The company employs three veterinary surgeons and some trained dairymaids to constantly examine the dairies and surroundings and to look after the healthy condition of the cows. At the station at Copenhagen samples from each farm are tested by smell, taste, and by the Babcock tester, besides being occasionally analysed. No milk is accepted until twelve days after calving, or from cows almost dry. The cows must not be fed with distillery slops, turnips, kohl-rabi, rutabagas, or the leaves from root crops; and if the milk is for children oilcake is prohibited, and only one peck a day of mangolds and carrots is allowed. The time for calving must also be distributed as evenly as possible over the year, and sufficient ice kept on the farm. The company owns and cleans all the cans, which hold 100 lb. of milk. From cans for delivery to consumers the supply is drawn from the bottom. The sweet milk is kept in round cans, and the skim in square cans. To equalise the distribution of cream with the milk, the tube or pipe, in which the discharge valve is placed is continued to the top of the can, and contains rows of small holes through which the milk is drawn from the whole depth of the milk.

The Devon Breed of Cattle.*

By J. L. THOMPSON,
Principal, Hawkesbury Agricultural College.

The northern part of the County of Devon, England, has long been in possession of a breed of cattle whose compactness and general beauty, activity as workers, and aptitude to fatten have made the county and the cattle alike famous. The Devon breed have their head-quarters in the Counties of Devon and Somerset, and have held sway there undisputedly for hundreds of years. If there is any truth in the statement that self-colour (that is, the same colour throughout) is a proof of the antiquity of a breed, then the Devons may be regarded as one of the purest breeds of cattle in existence. Red is the true Devon colour, although the red varies as to shade, from a rich dark-red to almost a pale chestnut. Still, the same colour prevails all over the animal, and no other colour is found upon it in patches.

Early Breeders in England.

Mr. Arthur Young, in his report, dated 1776, mentions Mr. Quartly, of Molland, as the most celebrated of the breeders at that time. Mr. Young describes the aims and objects of this early breeder. The points aimed at have chiefly been to gain as great breadth as possible between the hips; to have the hip-bones round and not pointed; that the tail should fall plumb without a projection of catch and rump, the tail not set on high, not to rise but be snug, and the line to be straight with the backbone; to be thick through the heart under the chine; that the shoulder point be not seen, no projection of bone, but to bevel off to the neck; all the bones to be as small as possible; the rib bones round, not flat; the legs as small as possible under the knee, to be sharp and thin from the throat to the nose; to be thin under the eyes and tapering to the nose, which should be white; to be wide between the eyes, the eyes themselves to be very prominent; the horns to be white, with yellow tips, thin at the root and long, spreading at the points; the breast or bosom should project as much as possible before the shoulders and legs, and the wider between the fore legs the better; the line of the neck, from the horns to the withers straight with that of the backbone.

An intelligent breeder like Mr. Quartly with so clear an ideal, so well-defined a model, and the relation of all important points so well reasoned out, could not fail to leave an almost indelible stamp upon the race on which he operated. No wonder that the fame of the Quartly Devons still lives, for the efforts of Mr. Quartly must have done much to mould the breed into the strongly-set type which it now displays. Down to the present day the Quartly strains are held in high esteem by all the leading breeders.

* Works consulted, Stephens' "Book of the Farm," and Youatt's "Complete Grazier," &c.

The points and characteristics of the modern Devon, as given by the late Mr. Vancouver, differ little from the description just given by Arthur Young as to Mr. Quartly's ideal:—Head small, clean and free from flesh about the jaws, deer-like, light and airy in its countenance; neck long and thin; throat free from jowl or dewlap; nose and round the eyes of a dark orange colour; ears thin and pointed, tinged on their inside with the same colour that is always found to encircle the eyes; horns thin and fine to their roots, of a cream colour, tipped with black, growing with a regular curve upwards, and springing from each other; light in the withers, resting on a shoulder a little retiring and spreading, and so rounded below as to sink all appearance of its pinion in the body of the animal; open bosom with a deep chest or keel; small and tapering below the knee; fine at and above the joint, and where the arm begins to increase it becomes suddenly lost in the shoulder; line of the back straight from the withers to the rump, lying completely on a level with the pin or huckles, which lie wide and open; the hind quarters seated high with the flesh, leaving a fine hair ham tapering from the hock to the fetlock; long from rump to huckle, and from the pinion of the shoulder to the end of the nose; thin loose skin; covered with hair of a soft and furry nature, inclined to curl whenever the animal is in good condition or in full coat, when it also becomes mottled with darker shades of its permanent colour, which is that of a bright blood-red, without white or other spots, particularly on the male; a white udder is sometimes passed over, but seldom without objection.

The editor of the Devon Herd-books says of the Devons:—The Devons make first-class graziers' and butchers' beasts, and although showing their highest condition, and seen in their greatest perfection, in their own habitat, they do well almost everywhere. They bear change of soil and climate well, thrive where many breeds would starve, and rapidly outstrip others when they have plenty of good pasture. Although small in appearance compared with larger breeds, as converters of vegetable into animal food; breed against breed, they return as much per acre, or for weight of food consumed, as any breed in existence. Their beef is of fine quality, and brings the highest price in the market. They withstand extremes of temperature. On a poor pasture, from their peculiar build, they are enabled to travel rapidly over the ground without fatigue, and get sufficient nourishment when the heavy breeds would starve. The very best of these beasts are the best in the world. The cry has been for animals that will mature early, and the Devon has answered it.

The Herd Book was first published in 1851, when there were entries from thirty-seven breeders in the first volume. In 1887, volume ten was published, and entries were received from 161 breeders. As the number of entries is yearly increasing, a volume is now published annually.

It will be seen that the Devons are increasing very much in numbers and in popularity, not only in England but nearly all over the civilized world.

Weights of Devons.

Devon cattle do not, of course, attain the weight credited to the larger breeds; but they are great for the apparent size of the cattle, while the percentage of dead meat to live weight is exceptionally high, and the amount of cheap meat relatively small. Specimens of the breed have reached as much as 19 cwt., live weight, at four years old, and Mr. Mitchell's bull, Country Gentleman, was fully this weight when exhibited at the Royal Agricultural Society's Show in August last.

At the Smithfield Fat Stock Shows, in London, the Devons take a prominent place in the prize list, and notwithstanding their small size, they have more than once carried off the one hundred guineas (£105) at the great Smithfield Fat Cattle Show for the best beast in the show. During recent years we find Mr. John Wortley's Frettenham Norwich carried off this prize in 1888, and also in 1891. An illustration is given of the steer which carried off this coveted prize in the last-named year. The champion was bred by T. H. Risdon, Taunton, and scaled 13 cwt. 3 qrs. and 16 lbs. at thirty-one and a half months old. He also carried off the Breed Cup at Islington, and was champion of the whole show. *The Live Stock Journal* in describing this magnificient animal says:—

"This shapely deep animal has fine bone, well-arched ribs, and great breadth, with excellent top and low lines, whilst he meets one well, and has plenty of firm handling flesh."

Her Majesty the Queen is a celebrated breeder and feeder of Devons, and carried off the first prize at Birmingham with a handsome straight by Sir Walter II, 2,143, bred at Windsor.

Devon Cows as Milkers.

Speaking generally the Devon breed of cattle are not of a high order for milking purposes. The percentage, however, of butter-fat is large, but the quantity is not very abundant, although many instances of heavy yields are on record. The mothers generally rear their calves well.

Devons as Workers.

For labour or draught purposes the Devons are celebrated, being active, docile, strong, and hardy. It is no uncommon day's work for four steers to plough two acres with a double furrow plough in England; harnessed like horses with collars and hames, &c.

There is no doubt the Devon breed of cattle was brought into existence to fulfil a peculiar mission, viz., that of converting the produce of sparsely grassed localities into the very best of meat which could not be done by large framed animals.

The following is a list of Devon breeders in this Colony, past and present, as given to me by Messrs. Pitt, Son, and Badgery, and Messrs. Hill, Clark, and Company:—

F. Reynolds, Tocal.
F. A. Parbury, Scone.
Geo. Loder, Singleton.
J. H. Doyle, Scone.
James Mitchell, Tabletop, Albury.
Bank New South Wales, Ben Lomond.
E. K. Grace, Gininderra.
R. Wyndham, Branxton.
Geo. T. Yeo, Mulgrave.
H. F. Smith, Casino.
George Rouse, Gulgong.
J. C. Manchee, Willow Tree.
H. C. White, Havilah.

The Tabletop Devons.

The foundation of the Tabletop herd of Devons was laid by the present proprietor, Mr. James Mitchell, about ten years ago, by the purchase of the whole of the females from the herd of the late Mr. H. C. White. Mr. White personally selected some of the best animals he could procure in England. Amongst others were: Annie II, 3,174; D.H.B. Bonny Lass, 3,223: Buttercup II, 3,245; Crafty V, 3,313; Curly II, 3,319; Damsel X, 3,372; Echo II, 3,419; Lily II, 3,643; Polly, 3,792; Primrose, 3,824; Young Beauty, 4,017; and Young May Rose, 4,023. With these cows was

imported the bull Prince Christian Victor, 1,187, bred by Her Majesty the Queen. In 1888, Mr. Mitchell imported four pure-bred Devon bulls, viz.:—

1. Foreman, 1,968, bred by Sir W. Williams, Bart.; sire, Duke of Flitton XVII, 1,344.
2. Foreman II, full brother to Foreman, 1,968.
3. Fisherman.
4. Monarch.

In 1890 Mr. Mitchell imported two more bulls, namely:—Sir John, 2,498, bred by Mr. John Risdon, Taunton, who sold him to Her Majesty the Queen before becoming the property of Mr. Mitchell. Sir John was by the celebrated bull Bondholder, 1,905; dam, Dolly's Darling, 8,788. The other imported bull was Tregothnan, bred by Viscount Falmouth; sire, Lord Wolseley, 2,063; dam, Dorothy Draggletail, 5,253.

In 1892 Mr. Mitchell further imported Country Gentleman, 2,741, bred by Mr. J. F. Morris, Barnstaple, England. His sire was Primrose Duke, 2,296; dam, Lady Mary. Country Gentleman gained the following prizes in England:—2nd prize, Somerset County Show, 1891; 2nd prize, Bath and West of England, 1891; 1st prize, Somerset County Show, 1892; 1st prize, Bath and West of England, 1892; 1st prize, Royal Agricultural Society of England, 1892. His sire, Primrose Duke, 2,296, was also a great prize taker.

Mr. Mitchell's latest importations were made during the present year (1895). They comprise first, Royal Duke, bred by Her Majesty the Queen; sire, Daisy's Dumpling, 1,933; dam, Butterfly XXIII, 10,410; second, Trump II of Pound, 3,362, bred by Alfred C. Skinner, of Pound Farm, Bishop's, Somerset; sire, Compensator, 2,943; dam, Tulip VI, 11,741. Compensator won five 1st, one 2nd, and one 3rd in 1893 and 1894.

Mr. Mitchell exhibited a splendid group of Devon cattle at the recent Show of the Royal Agricultural Society, Melbourne, which were very justly admired. The following prizes were awarded:—

Bull, three years old or over—1st and Champion, J. Mitchell's (Tabletop, N.S.W.) Country Gentleman.

Bull, two years old—1st, J. Mitchell's Trump II of Pound; 2nd, J. Mitchell's Royal Duke.

Bull, one year old—1st, J. Mitchell's Johnny.

Heifer, two years old—1st and champion, J. Mitchell's Curly, 318.

In the autumn of 1890 I had the pleasure of visiting Mr. Mitchel's beautiful estate, Tabletop. Recent rains had fallen, the grass was consequently green and succulent, and the beautiful ruby cattle grazing on the undulating slopes of Mount Tabletop was a sight worth going many miles to see. The whole herd, numbering 300 breeding cows, is, in my opinion, as near perfection as it is possible to breed them.

The Tocal Devons.

According to a *Leader* report, the Tocal herd of Devon cattle was founded by the late Mr. Charles Reynolds, father of the present proprietors. Mr. Reynolds, senior, had been brought up in England amongst the Devons, and was, therefore, well acquainted with the many excellent qualities possessed by this breed. Being satisfied that their requirements would be met by the climatic and other conditions which obtain in his adopted country, he lost no

DEVON STEER.

The property of Mr. John Wortley, Frettenham, Norwich; bred by Mr. T. H. Risdon, Washford, Taunton. Winner of Champion Prize as Best Beast at the Smithfield Club Show.

(11b 50-95-6)

GROUP OF DEVON CATTLE.

(116 50-95-6)

time in laying the foundation of [illegible] of this breed consisted of [illegible] are associated with the [illegible] estate. Cows were [illegible] Tasmania; and with these as a [illegible] built up. From time [illegible] breeders of England [illegible] the stock of such well-known [illegible] and Davy. The stud of [illegible] years. One of the [illegible] Flitton, North Ma[illegible] of Mulgrave, who was a [illegible] available blood has been [illegible] by many to be the finest [illegible] 100, and it is a pretty [illegible] grazing knee-deep [illegible] such uniformity and [illegible] lineage is at once apparent.

time in laying the foundation of his herd. Mr. Reynolds' first importation of this breed consisted of Mollana and Red Rover, two bulls whose names are associated with the pedigrees of many of the best animals now on the estate. Cows were obtained from Mr. Hobbler, who imported them from Tasmania; and with these as a foundation the present Devon herd has been built up. From time to time selections from the herds of the most noted breeders of England were added to the Tocal herd. The majority were from the stock of such well-known Devon breeders as Messrs. Turner, Harling, and Davy. The stud of the latter breeder has been famous for over 150 years. One of the most noted bulls ever used in the herd was the Duke of Flitton, North Malton, Devonshire, and imported by the late Mr. G. S. Yeo, of Mulgrave, who was a well-known breeder in this district. Only the best available blood has been used in the Tocal herd, and the herd is pronounced by many to be the finest in the colonies. The pure females number about 100, and it is a pretty sight to see the shapely all-reds in a good season grazing knee-deep in the splendid pastures on the Paterson flats. There is such uniformity and shape noticeable in the herd that the purity of their lineage is at once apparent.

Chemical Notes.

By F. B. GUTHRIE.

Beeswax.

A number of samples of beeswax were recently submitted for examination. These formed part of a shipment made by Messrs. Hebblewhite & Co. to London. The samples were taken from different parts of the consignment, and represent the wax of several different suppliers. The examination was made with the object of testing the purity of the wax supplied. The figures obtained may be of interest to bee-keepers:—

Appearance.	Melting point.	Specific gravity.
No. 1.—Yellow	64° cent.	·962
No. 2.—Golden yellow	63° „	·962
No. 3.—Golden yellow	64° „	·963
No. 4.—Light yellow	64° „	·962
No. 5.—Light yellow	64° „	·962
No. 6.—White	65° „	·968
No. 7.—Chocolate red	63·5° „	·960

On saponification with soda no fatty acids were precipitated on the addition of hydrochloric acid (absence of fats, resin, vegetable wax, &c.)

The above determination of the melting points and specific gravity show that substances such as paraffin, tallow, stearin, &c., are absent.

Special tests were made for these without result.

On fusing, the waxes, in all cases, melted to a clear homogeneous fluid, showing the absence of water, mineral matter, &c.

The above suffice to show that the samples examined were pure beeswax, free from adulteration of any kind.

No. 6 had. apparently, been bleached, which would account for the higher specific gravity observed.

Testing Babcock's Flasks.

A number of flasks supplied with a Babcock milk-tester were suspected of being incorrectly graduated, and were sent to the Department for report.

The scale divisions were found, in all cases, to be correct within the limits of error permissable by the test.

Attention is here merely drawn to the fact that the Department will, in all doubtful cases, test the accuracy of either flasks or pipettes supplied with this milk-tester, as everything depends upon their accuracy.

Fowl Manure.

The following analysis of a sample of the product obtained by the sweeping out of the fowl-roosts may be of interest to poultry-keepers:—

Moisture	= 3·95	
Volatile matter	= 16·48	(containing nitrogen = 1·47 equal to ammonia = 1·78)
Insoluble matter (earth and sand)	= 70·16	
Lime	= 2·10	
Phosphoric acid	= 1·94	(equivalent to 4·23 phosphate of lime).

The value of the above is about 16s. per ton.

Notices of some recent Text-Books.

Organic Chemistry (Bernthsen's). Translated by Dr. M'Gowan. (Blackie & Sons.)

This is the second English edition of the above work, which has established itself as a text-book of organic chemistry. The present is from the fourth German edition, and has been subjected to careful revision throughout, many of the sections having been re-written to include recent research.

In its present form it is a valuable work, either as a text-book for the beginner, or as a book of reference.

A feature which greatly enhances its value to the student is the reference to original papers in all cases of recent work, thus enabling the reader to pursue any subject of special interest beyond the limits of a text-book.

Inorganic Chemistry. G. S. Newth, F.I.C., F.C.S. (Longmans, Green, & Co.)

This is in every respect a work that can be most thoroughly recommended, more particularly to those who have not the advantage of verbal instruction. To some extent it breaks new ground, both in the arrangement of the matter and in the greater space devoted to general principles.

It is divided into three main parts, Part I dealing with general principles and the elucidation of theoretical views. This portion is more thoroughly dealt with than is usual in text-books, the chapters dealing with the atomic theory and atomic weights, the periodic system, solution, and thermo-chemistry being of special value and lucidity.

In Part II, four typical elements, hydrogen, oxygen, nitrogen, and carbon, and their more important compounds, are studied in detail, an arrangement which enables the student to become acquainted with several bodies of primary interest, such as air and water, at an earlier stage than usual.

Part III is occupied with the systematic study of the remaining elements.

Mr. Newth has based his classification of the elements upon the periodic system, and may fairly claim to have overcome or avoided the difficulties such a course entails.

Metallurgical processes are explained as briefly as possible, and the only regret one feels is that Mr. Newth has not carried out the promise hinted at in his preface and omitted them altogether.

Organic Chemistry.—The Fatty Compounds. R. Lloyd Whiteley, F.I.C., F.C.S. (Longmans, Green, & Co.)

This handy little volume confines itself to the study of the derivatives of the "fatty" hydro-carbons, and is of especial value to those who have means

at their disposal of following the many excellent practical experiments which are given throughout the work, and which are selected with judgment and carefully explained.

The chapters on the purification of organic bodies and the determination of molecular formulæ are of special value.

Organic Chemistry. W. H. PERKIN, Junr, F.R.S., and F. S. KIPPING, Ph. D., D. Sc. (W. and R. Chambers).

This may also be confidently recommended. The subject matter, though much condensed, is treated in a very readable manner, and the use of constitutional graphic formulæ throughout the work is a feature of special value to the beginner.

The highly important question of the constitution of organic compounds is indeed gone into more exhaustively than in most other text-books of its size, and in the concluding chapter on stereo-isomerism the subject is treated with special skill. The alkaloids and the dyes and colouring-matters derived from coal-tar are treated of at considerable length in separate chapters.

Ticks on Cattle.

In view of the prevalence of ticks in some portions of New South Wales it is thought that a short *résumé* of the valuable information given in a recent issue of the *Agricultural Journal* of the Leeward Islands will prove of service.

The first point which it is necessary to impress most strongly upon owners of cattle is that the forcible removal of ticks, either by means of scraping or cutting out, is to be unhesitatingly condemned. By such means either only the body of the tick is removed, leaving the mouth parts buried in the skin, or an open wound is left, which is liable to cause more harm than the presence of the tick.

It should be borne in mind that animals in a fat condition are hardly ever attacked by these parasites. Fat or grease of any kind is most obnoxious to almost any kind of insect. Hence, wherever possible all animals should be kept in sleek condition.

With regard to relieving animals on which ticks have already established themselves the system which has been found at once practical and effective is to spray them in the same manner as orchard trees are sprayed. Grazing cattle are usually somewhat wild, and in order to treat them by means of either drenching or smearing it would be necessary to rope and throw them, a course which is not only dangerous to the animals but quite unnecessary for the removal of ticks or other parasitic insects. In order to spray them it is only necessary to yard the animals and run them in turn into a narrow passage, where they can be retained while being thoroughly covered by means of the now well-known knapsack spray pump, and passed out again to the pasture. A long series of experiments has shown that there are several non-poisonous sprays which are both cheap and effective. Their composition is as follows:—Jeye's fluid 5 oz., water 40 oz.; Augean fluid 10 oz., water 100 oz. —this latter is mentioned as the best and cheapest. Liquids of an oily character are also valuable, and amongst the best known may be mentioned the kerosene emulsion, now greatly in demand by orchardists. The following formula of this mixture is applicable to the removal of ticks:—In two quarts of boiling water dissolve ½ lb. of soap; remove from fire; immediately add one pint of kerosene and agitate. In from three to five minutes the liquid becomes creamy. It may be stored in this form in bottles or barrels. For use add three of water to one of emulsion, mix thoroughly, and apply with a spray pump.

With regard to horses the following method is suggested by Mr. Hutcheon, the Cape Colony veterinary surgeon:—"In the case of horses which are grazed and only partly kept in the stable, a good plan is to wipe the following parts well with a cloth saturated with a mixture of paraffin and oil, viz., from the anus to the sheath between the thighs and around the hind legs, then along the belly and chest and around the fore legs, before turning them out

to graze. It is difficult to get a cheap preventive which is both harmless to the animal and cleanly to use. To moisten the coat with a weak solution of any of the tar or carbolic acid dips would answer if frequently applied."

In the direction of prevention about the simplest and best means appear to be the addition of a small quantity of sulphur to the solid food. The addition of sulphur to the food needs a little management. It may be done by scattering it in the form of a powder over the chopped food. Probably, where the cattle receive only grass, the addition of a small quantity of molasses will sufficiently cover the sulphur for them to be eager to take it. But the best method appears to be supplying some kind of "lick," usually with a preponderance of salt. The well-known Australian "lick" may be used with advantage:—214 lb. of salt, 14 lb. of sulphate of iron, 4 lb. of sulphur, and 2 lb. of ginger. But any form would probably be efficient which contained a fair quantity of salt and sulphur.

The moral appears to be—keep your cattle in good condition, and occasionally use a preventive.

Poultry Notes.

By S. Gray,
Sub-Editor.

Cramming Fowls.

I take the following from the English *Agricultural Gazette* :—"There is at present, and to my thinking there will always be, an excellent market for well-fattened fowl when they are properly killed and attractively offered to the public. In fact, in the present congested state of agriculture, poultry are the only stock on the farm which have maintained a uniform price during the last fifteen years. On suitable soil, and where the birds are intelligently bred and treated, they will undoubtedly make good returns, but it is only as an adjunct that these results can be guaranteed. Poultry farms, pure and simple—that is, independent of any other branch of agriculture, where land is specially rented, labour hired, and no poultry food produced on the land—have never been able to pay their way in the United Kingdom, save in very exceptional cases, though I believe in America the thousand-hen farm is now doing profitable business.

"To obtain the highest prices for table fowl the subjects must be artificially crammed between the ages of four and eight months, not younger and not older. There are two methods of artificial cramming, the old-fashioned pellet system, practised by our great-grandparents and the up-to-date semi-liquid course, which can be worked either with machinery or with the pewter funnel so popular among the Normandy and Houdan peasantry, who are now the producers of the finest table poultry in the world.

"The mediæval method of caponising, I need not allude to. It has been pronounced by many of our leading agriculturists as absolete, and I am glad to say that almost all the birds labelled 'capon' in our Christmas markets are simply specimens of our best table breeds, properly fed from the shell and then artificially crammed at five months old.

"The somewhat high price of the fattening machine deters most poultry keepers from investing in it; in fact, it is only at regular fattening depôts or on farms where four or five hundred fowls are kept that it is to be found. But the pewter funnel, which is now to be had in England for a few pence over a shilling, is a very good substitute. The tube is inserted in the bird's throat, and the liquid poured through it. The principle of the machine and funnel is the same, but the former will feed 300 head of fowl in an hour, its action being almost instantaneous and perfectly neat. After a few days practice, from thirty to forty fowls can be disposed of in the hour, and after less than a dozen meals the birds get over their alarm at being handled, and forced to harbour the foreign instrument in their throats. Sickly or anæmic birds should not be experimented on with any system of cramming.

"All the leading agriculturists of France are now of opinion that the semi-liquid course of feeding is the most perfect known.

"It is certainly more digestible than the solid pellet course, and it gives to the flesh of the average table fowl a juiciness, whiteness, and delicacy, which I have not seen surpassed as yet.

"It takes from sixteen to twenty days to fatten fully, and the meal is to be given three times in the twenty-four hours—early morning, noon, and night—at intervals of eight hours. But if any of the food be left in the crop after that time, the next meal must be postponed until the crop is quite empty; the consequences might be serious otherwise. The birds must of course be comfortably cooped or penned in a half-darkened shed or outhouse, as with pellet cramming.

"The components of the food consist of any kind of fine meal mixed with sharps, and made semi-liquid with skimmed, never with fresh, milk. Barley meal is especially recommended; it gives to the flesh that peculiar *nacré* (mother-of-pearl) hue which is so highly prized in the Paris *Halles*.

"All the husks should be carefully removed, and the liquid be as smooth as possible, able to pass freely through the tube of the funnel; thickish cream would be a guiding consistency. It should be mixed a little time before using, tested, and given tepid. For the first four days the milk must be half-diluted with water, and only half a tumbler given at each meal; but, after that, the full tumbler is necessary, and the watering of the milk should be stopped.

"Where milk is not available, sheep's offal may be boiled down, and the broth used to liquify the meal instead. It should be poured hot on the meal, and well stirred. Double quantities should be used for turkey cramming.

"I have before me the letter of a farmer's wife, just received, thanking me for bringing this funnel under her notice in the poultry column of a weekly paper. For her Christmas turkeys she only got 5d. per lb. in the wholesale market, and this year, after the semi-liquid course, she got 9½d. per lb."

In reference to the above, I should like to point out that this system might well be adopted with this season's chicks in the later districts of the Colony. Birds hatched out in September will be ready to fatten in January or February, and so be in time for the March to May market in London. The separated milk returned by the butter factories would answer the purpose admirably for mixing the food.

Freezing Poultry for Export.

For the benefit of those who wish to participate in the poultry export trade we give the following information, which was obtained from Messrs. Geddes, Birt, & Co. (Limited), in order to comply with the wish of a correspondent:—"In reply to your favour of the 19th inst., we beg to say that our charge for freezing poultry will be ⅜d. per lb. on the weight of the poultry so frozen. The freight on poultry quoted at present by the Thompson and Lund lines is 75s. per ton measurement of 40 cubic feet. The above charge of ⅜d. includes the labour of packing and delivery to steamer, but does not include cost of crates."

Practical Vegetable and Flower Growing.

Directions for the Month of November.

Vegetables should make fine growth very quickly wherever the season has been favourable. Unfortunately, in the western dry districts it needs considerable perseverence to raise good vegetables if the weather keeps dry, and then it is only possible to do so by the aid of a large amount of water.

This is a great time of the year for the growth of weeds of all kinds, and the keeping them in check necessitates a good deal of work if they are allowed to attain any size. They should be tackled whilst they are quite young and tender seedlings. If sheep dung be used for manure, it should not be applied fresh to the soil, but should be thoroughly rotted first in order to kill all seeds of weeds, which it generally contains in great abundance. It would be better to rot all animal manure, and especially if it is used as a mulch.

Beans, Kidney or French.—In the warmest parts of the Colony, plants raised from early-sown seed should now be bearing pods large enough for use. It is a great mistake to allow the pods to grow to their full size before they are pulled, for they become hard, and almost unfit to eat. It is a still greater mistake to allow any to become ripe, for then the plant will cease to produce more beans. Keep the ground well hoed between the rows, and if the weather and soil are very dry spread over the ground a thick dressing, usually known as a mulch, of coarse dung, leaves, dead grass, sea-weed, dry fern, or anything similar that may be convenient. This will save the plants from wilting, or perhaps dying. If water is sufficiently abundant for use in the garden some liquid manure could be made from horse, cow, or fowl dung, and applied (say) twice a week. This will be found of considerable benefit to all vegetables. Burnt rubbish of any sort will be of great value, and it will always be worth while to cart on to the vegetable garden the remains of burnt stumps and logs and the burnt soil about them. Seed of French beans of the dwarf, runner, scarlet runner, snake, or butter varieties may be sown in any part of the Colony, except in those places where frosts still occur. There is always a certain amount of difficulty with the runner or tall-growing kinds of beans, because it is necessary to fix up sticks or some other kind of support for them to climb over. On the other hand, the dwarf varieties need no support, and are extremely easy to manage. Great mistakes are often made by persons who start vegetable growing without some instructions, in sowing their seeds too deep in the ground, and too close together. French beans should be sown about 3 to 4 inches deep, and from 6 to 8 inches apart. In cases where they have been sown too thick the young plants can be moved to another bed without affecting their growth, if they be well watered before they are lifted, and watered again after the transplanting.

Beet, Red, and Silver.—Sow a row or two of seed in well dug up ground. If it is considered necessary to apply manure for the red beet, use only thoroughly well rotted dung. The best practice is to sow on ground that had been heavily manured for some previous crop. Freshly applied manure is likely to cause the roots to fork. As the silver beet is used for its leaves only, manure may be applied heavily.

Broccoli.—Sow a little seed and transplant any strong young plants you may have large enough to put out. This vegetable is very much like cauliflower and may be grown in the same manner.

Cabbage.—Sow a little seed occasionally, not much at a time but just sufficient to keep up a continuous supply of plants. Plant out a few strong young cabbages from the seed bed to some well manured ground. Cultivate well all the cabbages that have been planted out, and, to improve their growth, give them a good watering with liquid manure. Make a sort of basin round each plant by drawing away the soil to the depth of an inch or two. When the liquid manure has soaked into the ground, cover with the soil that had been drawn away. If the weather is very dry it will be advisable to spread a heavy mulch between the rows of cabbages or any other vegetables as advised for French beans.

Carrot.—Some seed may be sown in drills, and when the plants come up and have attained a fair size, thin out considerably. The ground should be well prepared by deep cultivation, and had better not be manured if it can be avoided, but it would be preferable to sow on land that had been heavily manured for some previous crop. The drills should be about 12 to 18 inches apart.

Cauliflower.—A little seed may be sown, either in a box or seed-bed, to be protected from the hot sun. Mulch the surface with some finely broken up dry cow-dung, and do not allow the soil to become dry.

Celery.—Sow a very little seed, if it is thought to be required, in a seed-pan or box, and if there are any plants available plant them out in richly prepared ground, either in prepared trenches or on the flat. A small bed of celery grown merely for flavouring soups, stews, &c., will be found of considerable value. In this case there will be no necessity to blanch the stalks. To grow celery well it requires plenty of well decayed farmyard manure and good supply of water.

Cucumber.—Sow seed in ground that has been well prepared by deep digging and rather heavy manuring. Draining should also be attended to. Any plants that are up and making headway should be pinched back as they extend their spreading shoots, in order to keep them bushy and compact. Plants which are not growing well should have some liquid manure from time to time, but this should be made very weak.

Cress and Mustard.—These two salad plants are usually grown together, and they are about as easy to grow as any plants can be. During the hot weather frequent applications of liquid manure will improve them and make them tender and crisp.

Egg Plant.—Plants from seed sown some little time back should be ready to plant out in the garden, 3 feet or more apart every way. It is hardly worth growing it to any great extent until it is ascertained that this vegetable is liked by the family. Seed may be sown, if plants have not been raised.

Leek.—Sow a little seed in the seed-bed, for succession. It is always well to have a few young plants ready to put out when required. Any small plants that may not be required for the garden will come in useful for the kitchen, no matter how small they may be. The leek is a greedy plant, and needs plenty of manure, and is greatly improved by frequent applications of

liquid manure and plenty of water. Plant out a few strong young leeks deep in the soil. Fair-sized plants that are growing well may be earthed up to make the stalks white and tender. This vegetable can be strongly recommended as being most wholesome.

Lettuce.—Plant out a few strong young lettuces from the seed-bed, but make the ground rich with well rotted manure before planting. They should be grown quickly at this time of year, or they will probably soon run to seed.

Maize Sweet.—This is a useful and palatable vegetable not often used in this Colony, but common enough and much liked in America. Sow in rows about four feet apart, and drop the corn about one foot apart in the rows. When it comes up, cultivate well the soil between the rows, but do not draw the soil in a ridge to the plants. Cultivate " on the flat."

Melons.—Sow a few seeds in well-prepared ground, in the same manner recommended for cucumbers. The pie, or preserving melon, should not be forgotten, as it is very productive and useful for preserve.

Okra or Gumbo.—Plant out a few seedlings if any are available, but if not sow some seed. This vegetable is useful for soups and stews. Its young seed pods contain a considerable quantity or glutinous matter, which is said to be wholesome and nourishing. The flowers are pretty, and the plant may be grown for ornamental as well as useful purposes.

Onion.—Sow a little seed, and keep the onion beds free from weeds. Scatter amongst any onions which you may have growing a mixture of soot and salt, half and half. This is a useful stimulant, and it will, in a great measure, prevent the attacks of worms and insects.

Peas.—A few rows should be sown, in cool and moist climates especially.

Peppers, Chili or Capsicum.—Plant out a few seedlings, and, if required, seed may be sown. A very few plants will serve for the purposes of a family.

Potatoes.—A few rows may be planted. Plant only whole potatoes of a medium size. Use plenty of rotten horse or cow dung.

Pumpkins.—Sow some seed in well-manured or rich ground. Plants that are progressing should be kept pinched back to prevent them rambling too much.

Radish.—Sow a little seed from time to time and use the plants as quickly as they are ready. Old radishes are almost useless and indigestible, and should be thrown to the pigs.

Rhubarb.—Sow a little seed in order to raise plants to put out next winter or early spring. This is a useful plant to grow, and no garden should be without it.

Sweet Potatoes thrive best in a warm sandy loam. They are generally considered to succeed only in tropical or semi-tropical climates, but the experimentalist at the Wagga farm found them to succeed very well there, and he raised some good samples. It is not likely to succeed in a cold heavy clay. Tubers should be planted in some warm rich spot to start them into growth, so that cuttings may be taken and rooted to plant out in beds prepared for them. The tubers will readily start into growth if laid out on a warm bed and covered about an inch or two with stable dung kept rather moist. The cuttings, or rooted plants, should be planted out in rows. These rows should be about four feet apart, and the cuttings should be planted one foot apart in the rows. When the vines are growing, it would be well to raise them occasionally to prevent them taking root at the joints.

Spinach.—Sow a little seed, but very little.

Tomato.—Sow seed in such quantity as may be required, and plant out from the seed-bed if any plants are available. Keep large plants tied up to some support if possible, and the fruit will then ripen better and be less liable to rot.

Turnips.—Sow a little seed in rows.

Vegetable Marrow and Squash.—Sow a little seed in the same way as recommended for cucumber.

FLOWERS.

DURING this month the chief work will be the keeping the weeds in check, trimming edgings and hedges, keeping walks clean and tidy, and grass plots cut short.

Roses should be in splendid bloom, especially the tea-scented and hybrid tea-scented varieties. If the rose seeds or seed vessels be cut off and the little branches on which they were growing be cut back an eye or two, fresh flowers will soon appear. Rose plants which are obtained from the nurserymen are generally grafted on some strong growing stock, and very frequently the stock is allowed to grow in mistake for the proper rose. Instances of this may be seen all over the Colony in the little gardens about town residences. Close attention will soon show the difference in the foliage of the variety of rose used for a stock, and any growth which appears about the stem or from the roots should be cut clean away. Give the roses a gallon or two of liquid manure occasionally, and it will make them thrive splendidly. There is no flower which gives more satisfaction than a rose, for it will stand no end of ill-treatment, and will always respond to attention and care.

Many kinds of bulbs flower well this month, and chief amongst them is the magnificent species known as the Hippeastrum, which is remarkably easy of cultivation, for, once it is planted, it may remain undisturbed for years, and will continue to flower without fail. Do not cut away the leaves of any bulbs which have finished their flowering, but let them die away of their own accord. These leaves gather material from the atmosphere which assists the bulbs to lay up a store of nourishment for the production of flowers next season. As the leaves die off, mark with sticks whereabouts the bulbs are growing, so as not so injure them when digging and clearing up the garden.

Dahlias may be planted at any time convenient. Take care that the tubers have a portion of the crown to each, otherwise they will not grow. The variety known as the cactus dahlia is one of the best to plant, and is coming into great favour. Single varieties, also, are very pretty, and are well worth growing. Some of the striped kinds are remarkably good.

Plant out balsams and any other tender kinds of plants which you may have raised. The balsam needs a rich warm soil to enable it to come to the greatest perfection. It needs also plenty of space in which to grow.

Orchard Notes for November.

During the first part of the month the fruit-growers of the coastal districts will do well to pay a little attention to an operation which, as a rule, they entirely neglect, viz., to thin their fruit. Apricots and peaches especially are prone to over-bear, the trees being often completely covered with fruit which they are quite unable to bring to anything like perfection. Trees that are allowed to over-bear only produce inferior fruit, which is hard to sell; whereas, trees that have been properly thinned out produce fruit of a large size and best quality, which will always sell, no matter how dull the market, as a really choice article will always find buyers, and in no market that I know of is this so readily seen as in Sydney. The question of thinning fruit is a very important one, and it is one that every fruit-grower in the Colony who wishes to make fruit-growing pay will have to study and practice sooner or later, as the neglect of thinning is causing our markets to be flooded with a very large quantity of very small and inferior apricots and peaches, which are practically unsaleable, as the rubbish—I cannot call it fruit—is fit for nothing. The question of whether it will pay to thin fruit has been conclusively proved over and over again in California, and there the wages are by no means low, being about 30s. a week and board for white men, and 30s. a week, without board, for Chinese. The general experience of thinning in California has been that trees thinned produce regular crops year after year; not a very heavy crop one year, which cripples the tree, and takes the next season resting to make up for it; also that trees bearing regular crops of large fruit require less manuring than trees that produce large numbers of pits and comparatively little flesh. It is the pits or stones, each of which in its kernel contains the germ of a tree, that take it out of the soil. The kernel contains a high percentage of nitrogen and phosphoric acid, the two most expensive plant foods which we have to supply in the form of manure, but the flesh of the fruit consists mainly of carbo-hydrates, which are obtained from the atmosphere and water. The main reason, however, that Californian fruit-growers thin their fruit is that there it does not pay to grow rubbish, which is of no value, and for which it is exceedingly difficult to find a market; whereas, large, even, good quality fruit is readily disposed of, no matter whether it is dried, canned, or consumed green.

In order to see that a judicious thinning will pay, choose a dozen trees of the same variety, of about the same size, and having about the same quantity of fruit on each. Leave six trees as they are, and thin the other six, so that every fruit that is left will have room to develop to its full size. Keep a full account of the cost of gathering and marketing the fruit from each lot of trees, and compare the net returns. I think many of our growers will be rather astonished at the result.

Apricots and peaches should be thinned just as soon as the second drop has taken place, or just as the stone begins to harden, as when thinned then there is no fear of any further drop, and the fruit taken off has not developed sufficiently to injure the tree. When thinning, one should have an idea of how much fruit the tree is able to bear without injury, and then thin accordingly.

With peaches, the fruit should be thinned to a distance of 4 to 5 inches apart, and where two fruits are growing together, either take off both or leave both, do not take off one and leave one.

With apricots, get the bulk of your fruit on the spurs along the main branches, and not right out on the ends of the branches, and thin out thoroughly so as to allow every fruit plenty of room. Large plums, such as Coe's Golden Drop, White Magnum Bonum, and Pond's Seedling will also pay well to thin, as also will pears and apples where too crowded. Where Codlin Moth, however, is very numerous, they will generally do all the thinning that is necessary, and often more than the orchardist cares about. Towards the end of the month the first crop of Codlin Moths will be reaching maturity, and this is easily detected by examining the affected fruit. As soon as the larvæ attain a fair size the bands should be placed round the trunks of the trees, which should have been previously well scraped to destroy all larvæ wintering under loose bark or in crevices of the tree, and all rubbish such as old boards, stakes, or other pieces of timber that are likely to form a shelter for the insects should be removed from the orchard. During the month keep the orchard well cultivated, especially if the weather is at all dry—stir the ground don't turn it, and it will thus retain the moisture necessary for the proper growth of the tree and fruit. Keep down all weeds in the orchard as they only form a refuge for many injurious insects, and if the weather is at all dry every weed is robbing the tree of the moisture that it cannot do without. Where there is irrigation available the orchard may be watered once during the month if required, but do not use too much water. Use no more water than is absolutely necessary, but give the land all the cultivation (stirring) possible to retain moisture. Examine orange and lemon trees carefully for any trace of the Rust Mite or Maori, and spray the trees with sulphur and soft soap at once if any are discovered. If Red Scale, Black Scale, or Broad Scale is troublesome, spray with kerosene emulsion to which as thick a solution of starch as will pass through the nozzle should be added. This will form a glaze or skin which will crack and peel off when dry, taking the scales along with it.

Attend to the work in the nursery, see that the trees are kept free from weeds, and that the ground is well stirred. Keep down all suckers—cut any ties that may not previously have been cut, and stake up any buds or grafts that may be growing crooked. During the month cherries will come in from the earlier districts. See that they are well and lightly packed, and the top well faced, as a little extra trouble in packing often makes a difference of over a penny a pound in the price of the fruit. As these notes have now been written for each month of the year, I think I cannot do better than conclude with the following advice, which is especially applicable at the commencement of the fruit season, and that is to send nothing but good fruit to market, and to so grade it, pack it, and market it, that it will show off to the best advantage, when, instead of being a drug on the market, it will be readily sold, and instead of landing the grower in loss will bring him in a good profit.

Fruit-growing to be a success now, must be conducted on far different lines from what it has been in the past; the old easy-going lines for fruit-growers are gone, and the man who wants to make fruit-growing pay must keep up with the times, and use his brains as well as his hands.

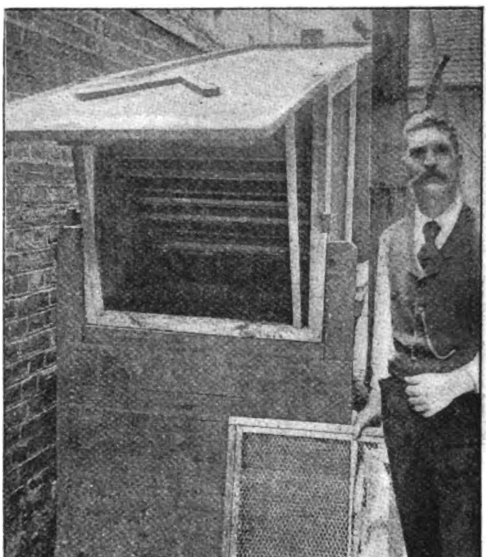
He must keep his trees well pruned and judiciously manured—his orchard free from all kinds of diseases, and in the highest state of cultivation; and he must grow nothing but first-class fruit, which, no matter whether it is used fresh, or is canned, dried, made into jams or jellies, or exported, will be a credit to our Colony.

General Notes.

A New Fruit-dryer.

In the Fruit Conference Bulletin recently issued there appear illustrations, together with a description, of a new fruit-dryer. The credit of making and exhibiting this fruit-dryer should have been given to the Universal Nursery Company of Wahroonga instead of to Mr. Jefferson, who simply appeared on the occasion in question as one of their staff, though at the same time he is the acknowledged inventor of the dryer, and it was probably on this account that the misunderstanding occurred. At the request of the company we reproduce both illustrations and description:—

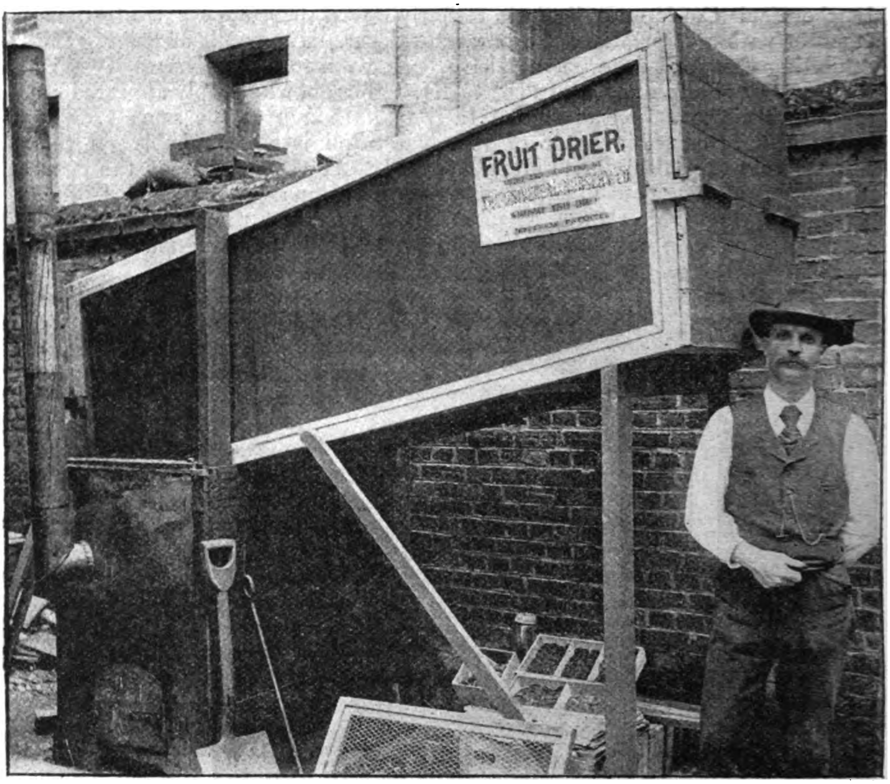
"For drying, fruit should be picked fully ripe, but not too soft to cut. As soon as possible cut and pit (stone) the fruit. In cutting make a clean



cut around the suture, dividing the fruit in equal halves; extract the pit and place the fruit, cup upwards, on the tray. After pitting, place the fruit in the sulphur-box, which for a small drying-plant may be constructed at a

cost of a few shillings. Allow the sulphur fumes to thoroughly permeate the fruit for about one hour, in order to give it a bright appearance, and also to destroy insect lava. The drier, of which accompanying sketches are given, was exhibited at the New South Wales Fruit Conference, and was constructed by J. S. Jefferson, recently from California, and is built on the same principle as the best Californian evaporators.

"The heat is supplied by a dome-shaped furnace, which thoroughly radiates the former throughout the hot-air chamber. From here the heated air rises and passes to the fruit-receiver. In the latter the trays slide on runners, and are so arranged that each row of trays catches a portion of the hot air.



This air is kept in motion until it reaches the end of the chamber, where, laden with moisture, it rises and escapes by a vent on top. By placing the hand on this opening a strong current of hot air will be found escaping when the drier is at work. The furnace is equally adapted to burn wood or coal. The evaporator will dry four hundred pounds of green fruit in twenty-four hours, and as the current of hot air passes over and under the fruit the latter is dried on top and bottom at the same time. The machine can be easily taken apart and shipped. In its construction lightness and strength are combined."

Remedy for Potato Scab.

A package of diseased potatoes received at the Department was found by Dr. Cobb to be affected by the fungus, causing the disease known as scab. The following remedies were recommended:—

1. Discard such potatoes as seed, or, if scabby potatoes must be used, they should be first soaked in a cold solution of 2 oz. of corrosive sublimate (*very poisonous substance*) in every sixteen gallons of water, made up in a wooden vessel such as a cask or wooden tub. Metal must *not* come into contact with this solution, or both the solution and the metal will be spoiled.
2. Land that has borne scabby potatoes will continue to infect new crops. It is, therefore, preferable to move to new land, and this should not be such as has received drainage from infected land.
3. In buying seed stipulate that the seed shall come from a non-scabby crop.

These measures will rid any grower of scab in a season or two.

AGRICULTURAL SOCIETIES SHOWS, 1895–6.

1895.

Society.	Secretary.	Date.
Dapto A. and H. Society	A.B.Chippindale	Jan. 8,
Albion Park A. and H. Society	T. Armstrong	„ 16, 17
Kiama Agricultural Association	J. Somerville	„ 24, 25
Moruya A. and P. Society	J. Kay	„ 29, 30
Lismore A. and H. Society	G. T. Hindmarsh	„ 30, 31
Wollongong A. and H. Association	J. A. Beatson	„ 30, 31
Berry A. and H. Society	A. J. Colley	Feb. 5, 6, 7
Alstonville A. and H. Society	H. R. Elvery	„ 7, 8
Bega A. and P. Society	A. J. Wilson	„ 12, 13
Gosford H. and A. Association	J. MacIntyre	„ 15, 16
Ulladulla (Milton) A. Association	C. A. Cork	„ 19, 20
Uralla P. and A. Association	J. D. Leece	„ 19, 20
Candelo A. Association	C. H. Brooks	„ 19, 20
Berrigan A. and H. Society	R. D. Drummond	„ 20
Lithgow A., H., and P. Society	M. Asher	„ 21, 22
Nepean District (Penrith) A., H., and I. Society	R. Benaud	„ 21, 22
Tumut A. and P. Association	W. A. Bridle	„ 26, 27
Camden A. and H. Society	W. R. Cowper	„ 26, 27, 28
Robertson A. Society	R. J. Ferguson	„ 27, Mar. 1
Goulburn A., P., and H. Association	J. J. Roberts	Mar. 14, 15
*Combined New England District Show (Glen Innes and Armidale Association)	John A. Martin.	„ 20, 21
Gundagai P., A., H., and I. Association	W. E. Kyle	„ 21, 22
Crookwell A. and P. Association	H. J. Peard	„ 21, 22
Cudal A. and P. Society	C. Schramme	„ 26
Cooma P. and A. Association	W. Madgwick	April 3, 4
Tenterfield P. and A. Society	J. Harker	„ 5, 6, 7
Taralga A. and P. Association	J. J. Walsh	„ 6, 7
Berrima District (Moss Vale) A. and H. Society	J. Yeo	„ 7, 8, 9
Liberty Plains H. Society	W. M. Thomas	„ 10
Royal Agricultural Society of New South Wales	F. Webster	„ 10 to 16
Walcha P. and A. Association	H. Chapman	„ 13, 14
Cootamundra A., P., H., and I. Association	T. Williams	„ 13, 14
*Inverell P. and A. Association	J. M'Ilveen	„ 14, 15
Castle Hill A. and H. Association	F. H. G. Rogers	„ 15, 16
Namoi (Narrabri) P., A., and H. Association	J. Riddle	„ 17, 18, 19
Wellington P. and A. Society	R. Porter	„ 18, 19
Mudgee A. Society	J. M. Cox	„ 18, 19
Williams River A. and H. Association	W. Bennett	„ 24, 25
Warialda P. and A. Association	W. B. Geddes	„ 24, 25
Bathurst A., H., and P. Association	W. G. Thompson	„ 24, 25, 26
Hunter River A. and H. Association	W. C. Quinton	May 1, 2, 3, 4
Coonamble P. and A. Association	F. R. Salt	„ 8, 9
Gwydir P. and A. Association (Moree)	J. G. Cohen	„ 8, 9
Macleay A. and H. Association (Kempsey)	H. R. Gray	„ 8, 9, 10
Upper Manning (Wingham) A. and H. Association	P. Doust	„ 9, 10
Walgett P. and A. Association	P. W. Kenny	„ 14, 15
Nyngan and District P. and A. Society	E. H. Prince	„ 15, 16
Central Australian P. and A. Association (Bourke)	J. W. Martin	„ 22, 23
Cobar P. and A. Association	W. Bedford	„ 29, 30
Riverina P. and A. Society (Jerilderie)	W. A. Mackie	July 23, 24
Hay P. Society	F. W. Blanche	„ 25, 26
Condobolin P. and A. Association	W. H. Garnsey	„ 30, 31
Narandera P. and A. Association	J. F. Willans	„ 31, Aug. 1

* District National Prizes to be offered.

1895.

Society.	Secretary.	Date.
Forbes P., A., and H. Association	W. G. Dowling	Aug. 8, 9
Parkes P., A., and H. Association	H. S. Howard...	,, 14, 15
Northern A. Association (Singleton)	C. Poppenhagen	,, 28, 29
Temora P., A., H., and I. Association	W. H. Tubman	,, 28, 29
Grenfell P., A., and H. Association	Geo. Cousins ...	Sept., 4, 5
Albury and Border P. and A. Association	G. E. Mackay...	,, 11, 12
Germanton P. and A. Association	H. R. Bridson...	,, 18, 19
Junee P., A., and I. Association	T. C. Humphrys	,, 18, 19
Burrowa P., A., and H. Association	J. H. Clifton ...	,, 19, 20
St. George's Horticultural Society	C. H. Halstead.	Oct. 18, 19
Horticultural Society of New South Wales	H. H. B. Bradley	,, 24, 25

1896.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindale	Jan. 7, 8
Albion Park A. and H. Association	T. Armstrong...	,, 15, 16
Kiama Agricultural Association	J. Somerville ...	,, 23, 24
Gosford A. and H. Association	W. McIntyre ...	,, 24, 25
Wollongong A., H., and I. Association	J. A. Beatson ...	,, 29, 30
Shoalhaven A. and H. Association	T. C. Kennedy...	Feb. 13, 14
Ulladulla Agricultural Association	C. A. Cork ...	,, 18, 19
Cobargo A., P., and H. Society	T. Kennelly ...	,, 18, 19
Southern New England (Uralla) P. and A. Association	J. D. Leece ...	,, 25, 26
Tumut A. and P. Association	N. Emanuel ...	,, 25, 26
Alstonville and Richmond River F., C., A., and H. Society	H. R. Elvery ...	,, 25, 26
Camden A., H., and I. Society	W. S. Cranfield	,, 26, 27, 28
Robertson Agricultural Society	R. G. Ferguson	Mar. 3, 4
Bega A., P., and H. Society	J. Underhill ...	,, 4, 5
Inverell P. and A. Association	J. M'Ilveen ...	,, 5, 6, 7
Luddenham A. and H. Society	R. G. Megarrity	,, 10, 11
Berrima District (Moss Vale) A., H., and I. Society ...	J. Yeo	,, 10, 11, 12
Goulburn A., P., and H. Society...	J. J. Roberts ...	,, 12, 13
Cumnock P., A., and H. Association	T. Howard ...	,, 17
Armidale and New England P., A., and H. Association	W. H. Allingham	,, 17, 18, 19
Port Macquarie and Hastings District A. and H. Society	J. Y. Butler ...	,, 18, 19
Gundagai P. and A. Society	A. Elworthy ...	,, 19, 20
Lismore A. and I. Society	W. Moses ...	,, 19, 20
Cooma P. and A. Association	W. M. Madgwick	,, 25, 26
Royal Agricultural Society of New South Wales ...	F. Webster ...	April 1 to 7
National Pomological Society	H. R. Whittell..	,, 15 (about)
Namoi P., A., and H. Association (Narrabri)	J. Riddle ...	,, 15, 16, 17
Warialda P. and A. Association	W. B. Geddes...	,, 22, 23
Hunter River A. and H. Association (West Maitland)...	W. C. Quinton	,, 22, 23, 24
Richmond River A., H., and P. Society (Casino) ...	J. T. Tandy ...	,, 23, 24
Hawkesbury District Agricultural Association... ...	C. S. Guest ...	May 9, 10, 11
Coonamble P. and A. Association...	F. R. Salt ...	,, 13, 14
Warren P. and A. Association	F. C. Tompson...	June 4, 5
Urana P. and A. Society	C. N. Culley ...	July 18, 19
Temora A., H., and I. Association	W. H. Tubman...	Aug. 29, 30
Albury and Border (Albury) P., A., and H. Society ...	G. E. Mackay. .	Sept. 10, 11

Secretaries of Societies are asked to forward dates of forthcoming Shows as soon as decided.

[Three Plates.]

Canning Downs Rust Resistant—Five shillings per bushel.

The name given to this wheat would imply that it has rust-resistant properties. It has, and it certainly is early enough to be a rust-escaping sort. The grain is of fairly good quality. In appearance the Canning Downs Rust-resistant resembles a number of wheats now grown in India, and we believe that it is, in fact, related to them, if not of them. All such wheats are remarkable for their ability to yield something of a crop, even on poor land and with bad treatment. It yields much more than one would suppose from its appearance. The grain is acceptable to Australian millers.

PROMINENT CHARACTERISTICS.—Short, weak, yellowish straw, whitish or rosy bearded heads, yellowish pointed grain of medium size and good quality, very early, yields fairly well, both rust-resistant and rust-escaping, not liable to shel

Clawson—Five shillings per bushel.

Defiance—Five shillings per bushel.

Pringle's Defiance is a hardy, prolific, latish wheat, resistant to rust, and yielding a grain almost identical with that of Blount's Lambrigg. It stools freely, and thrives—that is, yields some sort of a crop,—even on rather poor land and with poor treatment. Wheats answering this description are grown in all the Australian colonies, the most prominent of which is Smith's Nonpareil.

PROMINENT CHARACTERISTICS.—Medium height, strong whitish straw, bald whitish or yellow heads amber grain of medium size or small, late, productive, rust-resistant, somewhat liable to shell. Easily milled, yields fair percentage of fairly strong flour, with good quantity of gluten.

Early Para—Five shillings per bushel.

Early Para is among the earlier of the prolific and rust-escaping varieties. It stools well but does not creep, and its grain is of very good quality. If only by selection the straw could be strenghtened—a matter of no great difficulty, we believe—this variety would eclipse many of the sorts now grown. If sown early, it ripens its grain before the warm moist spells likely to occur in late mid-summer. This variety originated, we believe, in South Australia, and for a season or two it was much spoken of as the coming variety. It has been tried in all the Australian colonies. It is related to King's Jubilee.

PROMINENT CHARACTERISTICS.—Medium height, weak and brittle white straw, bald whitish heads, yellowish grain of medium size and good quality, very early, rust-liable, but escaping if sown at the proper season, prolific, little liable to shell.

Farmer's Friend—Five shillings per bushel.

Grosse's Prolific—Five shillings per bushel.

Grosse's Prolific may be called an abbreviated purple-straw wheat. Except in form it completely resembles the purple straws, being delicate, and very liable to rust, but a great yielder in a good season, and on good well-cultivated land. Though the ears are short, they contain a surprising amount of grain. This wheat will stand gales without breaking down, and without much shelling. The grain is of very good milling quality, from the Australian point of view.

PROMINENT CHARACTERISTICS.—Rather short, strong stiff purple straw, short bald club-shaped ears, large yellow grain of good quality, rather early, productive, rust-liable, does not shell.

Hudson's Early Purple Straw—Seven shillings and sixpence per bushel.

This will not do very well in an adverse season or on badly drained ground. It is very liable to rust, but being a very early wheat, it will usually ripen its grain early enough to escape the bad effects of the warm moist weather likely to occur in October and November. If sown early it will ripen in November, if the season is fairly good. Hudson's Early Purple Straw is a very prolific wheat, and is beyond question one of the very best of the purple straw sorts. It is not now grown to any extent here, but it is sure to come into favour as soon as it can be distributed and becomes known. Steer's Early Purple Straw, Farmer's Friend, Fillbag, Rattling Tom, Red Straw, Northern Champion, Jacinth, and possibly Red Tuscan, are different strains of purple Straw, very similar in form to Hudson's Early Purple Straw, and equally rust-liable, but for the most part are later. All are prolific.

PROMINENT CHARACTERISTICS.—Tall, strong, purple straw, large bald rosy heads, large yellow grain of superior quality, quite early, very productive, very rust-liable, not liable to shell. Yields good quantity of flour of good colour and fairly strong, but low percentage of gluten.

Improved Fife—Five shillings per bushel.

Fair milling wheat, yielding very strong flour of good colour and high percentage of gluten.

Improved Fife is a hardy rust-resistant late sort—a typical Fife; it stools well, is fairly prolific, and yields a grain of good quality, rich in gluten, and valued in America by the millers. Where lateness is not an objection, it is worthy of attention. It must be sown early,

PROMINENT CHARACTERISTICS.—Medium height, strong yellow straw, bald, rosy ears, small yellowish grain, valued in America by millers, late, fairly productive, somewhat liable to shell, rust-resistant

King's Jubilee—Five shillings per bushel.

This is one of the very earliest varieties. It stools fairly well, and yields well on good soil. The structure or composition of its tissues renders all its parts weak and brittle. It is very liable to rust, but if sown early it ripens before much damage is done. This wheat will never give satisfaction except in situations protected from strong winds, and where there are no heavy downpours, as both these agencies cause it to lodge dreadfully. It will also lodge from its own weight on land rich in nitrogen. We believe that by selection this wheat might be improved in respect to its weak straw, and it would then be a very useful variety—one that might possibly do for the warm moist coast districts. We believe King's Jubilee originated in South Australia some years ago. It has not come into general cultivation. Early Baart is one of the parents of this sort.

PROMINENT CHARACTERISTICS.—Medium height, weak and brittle straw, bald whitish ears, long whitish grain of medium size and good quality, very early indeed, productive, not liable to shell—in fact, rather difficult to thresh, liable to rust, but frequently escaping on account of earliness.

Blount's Lambrigg—Five shillings per bushel.

The Australian Blount's Lambrigg originated with Mr. Wm. Farrer in the Queanbeyan district, New South Wales, from seed imported from America. It has found favour in many parts of the country, and more and more of it is grown from year to year. It has a marked power to resist rust, and is to be highly recommended on that account. The grain is of only fair milling quality. This variety will not do well on naturally wet land, nor in a very wet season, except the drainage be good. It is a late wheat, and must be sown early. It is not suitable for coast districts. It belongs to the Defiance type, and closely resembles Pringle's Defiance and Smith's Nonpareil. It is better suited for export than for the Australian home market.

PROMINENT CHARACTERISTICS.—Of medium height, tough straw, bald yellow ears, small flat grain, of fair milling quality, late, good yielder, resistant to rust, not likely to shell.

Leak's—Five shillings per bushel.

Leak's is hardy and fairly prolific sort, having the form of the Fife wheats, not early nor yet late, yielding a grain of fair milling quality. It resists rust fairly and is free from shelling, and on these accounts is cultivated to considerable extent in Australia, especially South Australia. It should be sown early. It holds the grain well.

PROMINENT CHARACTERISTICS.—Above medium height, yellowish (somewhat brittle) straw, bald yellowish ears, yellowish grain of medium size and fair quality, rather late, fairly productive, fairly resistant to rust, not liable to shell. Grain easy to mill and yielding flour of good colour, fair strength, and a good percentage of gluten.

Marshall's White—Five shillings per bushel.

Poland—Seven shillings and sixpence per bushel.

This peculiar variety is late, and is useless for flour. It is used for green stock food in some parts of Europe; and this leads us to call attention to it here as being worthy of trial for those purposes in this country. The grain is rich in gluten, and is suitable for macaroni and for stock. It is much grown in North Africa—for instance, in Egypt and Algeria. It is sometimes called Mammoth Rye. It is very resistant to rust.

PROMINENT CHARACTERISTICS.—Very tall, very strong, yellow straw, very large, chaffy, bearded pendulous ears, very large, long, dark grain of very poor milling quality, mid-season, rust resistant, prolific, not liable to shell.

Steinwedel—Five shillings per bushel.

The grain of Steinwedel is starchy, but of first-class milling quality from the Australian point of view, and consequently it brings a good price in Australia. Owing to its earliness, this variety escapes rust in many districts if it is sown early and well on good land. It is unsuitable for coast regions. This sort must be harvested promptly whenever it becomes ripe.

PROMINENT CHARACTERISTICS.—Tall, strong, purple straw, large, bald, rosy ears, large yellow grain of very good quality, early, very productive, very rust-liable, shells badly.

Sicilian Square-headed Red—Five shillings per bushel.

Hard to mill. Flour yellow with high percentage of gluten.

Velvet Pearl—Five shillings per bushel.

Velvet pearl is a very early wheat, giving a grain of very good milling quality, from the Australian point of view, but is only a fairly good yielder, as it stools rather sparingly in an upright manner. It will stand a dry climate, in fact seems particularly suited to such. Although the stools are small, this is easily compensated for by thicker sowing. The bulk of seed per acre is about the same as for other varieties, the seed being small. The wheats, of which this is an example, seem to have come into favour in but few parts of the world. The variety known as Red Californian, with velvet chaff, appears to be identical with the present; both resemble Allora Spring, but the latter has not velvet chaff. New Zealand Velvet appears to be the same as Velvet Pearl. A wheat known as Mexican, or Red Mexican, is identical with this. Velvet Pearl is early—early enough, perhaps to be called rust-escaping. It is identical with Blé de Mars de Californie of France. A considerable quantity of it is grown in South Australia and New Zealand.

PROMINENT CHARACTERISTICS.—Medium height, short, bald, velvety, red heads, smallish white grain of good quality, very early, fairly good yielder, liable to shell.

White Lammas—Five shillings per bushel. (Nearly all spoken for.)

This handsome, freely-stooling, prolific, hardy, mid-season wheat is well known and deservedly popular. It is not resistant to rust, and yields grain of very good quality. It is suitable to any but the coast districts. It varies considerably in form, but is easy to recognise. A wheat we have observed under the name of Scotch Wonder also resembles the White Lammas, but is taller and more slender in all parts, even the grain being proportionately narrower, though equally blunt at both ends. Dallas is a wheat much like White Lammas, but inferior to it. It has slenderer heads with smaller awns. The grain of White Lammas is typical of those held in favour by Australian millers.

PROMINENT CHARACTERISTICS.—Tall, strong straw, bald whitish ears, tips of chaff salmon-coloured, large yellowish grain of good milling quality, mid-season, good yielder, not resistant to rust, does not shell. Very easy to mill, and yielding fairly strong flour of good colour, and a good percentage of gluten.

White Tuscan—Five shillings per bushel.

White Velvet—Five shillings per bushel.

It is quite liable to rust, but is rather early, and may escape rust on that account. It stools fairly well, and as the grain is small, it requires less bulk of seed per acre than the larger grained sorts. Our impression is that it does best in limestone country. It stools well, but does not creep.

PROMINENT CHARACTERISTICS.—Medium height, white straw of medium strength, bald, white, velvety heads, beautiful small, white, plump grain, of excellent milling quality; moderately early, productive, rust-liable, not liable to shell.

One-pound packages of Seed-wheat from Stud-plots.

A number of farmers having intimated their intention to grow seed-wheat in the same manner as is now done at Wagga, I will sell a few pounds of seed from the stud-plots at 1s. per pound, prepaid. This is the best seed it is possible to buy, and is suitable for use in starting stud-plots, as advocated by Dr. Cobb, the seed being in fact taken from the stud-plots at Wagga. The following sorts are available :—

Allora Spring
Australian Talavera
Bellevue Talavera
Berthoud
Canning Downs Rust Resistant
Velvet Pearl
White Lammas
White Velvet
Blount's Lambrigg
Marshall's No. 3
White Tuscan
Algerian
Defiance
Early Para
Farmer's Friend
Grosse's Prolific
Hudson's Early Purple Straw
Improved Fife
King's Jubilee
Leaks
Belatourka

I offer also any of the following numerous sorts, which are the original stock from which selections were made. This gives every farmer a chance to try any wheat known in this country, or, roughly speaking, in the whole world. Price sixpence per packet of one ounce, by post, prepaid.

1A1, 301.
Adamant, 164.
Advance, 192.
African, 252.
Agate, 381.
Algerian, 317.
Algerian Pearl, 195.
Allora Spring, 1042-1047.
Allora Spring, 1036-1041.
Allora Spring, 23.
Altkirch, 152.
American Purple Straw, 378.
Amethyst, 276.
Anglo-Canadian x Improved Fife x White Naples, 15 D.—x breds.
Anglo-Canadian x Improved Fife x White Naples, 11 D.—x breds.
Autumn Saumur, 270.
Anderson's R. R., 46.
Andriola Amber, 4.
Andros, 205.
Anglo-Australian, 5.
Annis, 260.
Archer's Prolific, 403 B.
Atlanti, 206.
Australian Amber, 279.
Australian Bearded Wheat, from P. Murdock, Port Germain, S.A., 8 A.
Australian Club, 400.
Australian Glory, 130.
Australian Glory, 342.
Australian Poulard, 316.
Australian R. R., 45.
Australian Talavera, 945-965.
Australian Talavera, 426-431.
Australian Wonder, 91.
Australian Wonder, 286.

Bailey, 397.
Banater, 104.
Bancroft, 224.
Bancroft Improved, 225;
Banham's Browick, 44.
Barbu à gros grain, 111
Barwick, 332.
Barwick, 939-944.
Barwick, 945-965.
Basalt, 396.
Battlefield, 289.
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Bellvue Talavera x Vermont x White Fife, 11 B.—x breds.
Bellvue Talavera x Ladoga, 12 D.—x breds.
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Berthoud, 1119-1134.
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Blount's Fife x Ward's Prolific, 17 A.—x breds.
Blount's Fife x Ward's White x Ward's White, 18 B.—x breds.
Blount's Fife x Vermont, 9 B.—x breds.
Blount's Fife x Vermont, 10 B.—x breds.
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